STUDY S-244

THE EVALUATION OF SELECTED PRESENT AND POTENTIAL POVERTY PROGRAMS

Richard Muth

INSTITUTE FOR DEFENSE ANALYSES
ECONOMIC AND POLITICAL STUDIES DIVISION

January 1966

Log No. IDA/HQ 66-5594
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FOREWORD

In February 1965 the Institute for Defense Analyses, in response to a request to undertake a study for the Office of Economic Opportunity (OEO), organized a Poverty Research Project whose activities were completed in December of 1965. During this period, the project activities were reported to OEO in a series of thirteen working papers, which, together with a draft of a project summary report, have been under review since January 1966. A summary of the IDA research activity was presented to OEO in a briefing on 28 January 1966.

This document is one of several formal publications resulting from that work. The results reported here are incorporated in a project summary report written by the project leader, Richard F. Muth:

R-116 - Federal Poverty Programs: Assessment and Recommendations, January 1966.

Other supporting publications are:

S-245 - The Distribution of the Gross Benefits of Present Federal Welfare and Income-Maintenance Programs, Neil S. Weiner, February 1966.

S-246 - An Evaluation of the Reduction in Poverty Among Various Demographic Groups, 1947-1963, Richard X. Chase.

P-272 - Evaluating the Returns to Regional Economic Development Programs, Stanley W. Besen.

P-273 - Poverty and Labor-Force Participation, Anthony Fisher.

P-274 - Areas of Declining Employment, Bette S. Mahoney.

P-275 - The Structural Change Hypothesis for Employment Among Youth, The Aged, and Minorities: A Critical Analysis, Richard F. Muth.

P-276 - Comparison of Alternative Methods of Projecting the Poverty Rate, Richard F. Muth.

P-277 - Determination of Poverty Lines and Equivalent Welfare, Elliot Wetzler

P-278 - Projection of the Number of Poor Families to 1970 and 1975, Elliot Wetzler

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SUMMARY

This Study attempts to evaluate the efficiency of alternative programs aimed at increasing the incomes of poor families. It deals with programs involving education and training as well as those which represent direct measures for increasing family income (specifically, adjustment of transfer or tax payments and measures to increase wages earned).

The effects of these two types of programs--education and direct income remedies--are not strictly comparable, since the former involves long-term effects over the life of the worker while the latter have an immediate impact on family income. In order to compare such programs a common measure of efficiency is needed. The one chosen here is the annual cost to the government of raising income by $100 per year (pre-tax, post-transfer) until the worker reaches age 65. A rate of 9 percent was used to discount future income.

In evaluating education and training programs the criterion applied in judging benefits is not the change in employment but the increase in the workers' future earnings. This criterion is used because some unemployed may find jobs without additional training and some graduates may lose jobs after initial placement, and because the long-run effect of training programs is probably higher earnings, not lower overall unemployment rates. In the absence of adequate data on the benefits of education and training programs, it was assumed that Head Start or nine months of MDTA or Job Corps training would yield the same average increase in earnings as an additional year of high school education.

Measures to increase family income directly are evaluated in two stages: first, the effects on income of changes in wage rates, transfer payments, and taxes in order to determine the extent of adjustments in each factor necessary to achieve a given increase in income; second, the Federal costs associated with adjustments that will achieve a $100

increase in family income are determined. Total family income consists of income from earnings (determined by wage rates, hours worked, and labor-force participation rate) and non-earnings income (comprising income from property and transfer payments).

The response of total income to an increase in wage rates depends on which of two effects dominates: the substitution effect in which the worker with higher income consumes less leisure and more commodities; or the income effect in which the consumption of commodities including leisure increases with income. Tax reductions, by making more of the worker's earnings available to him, can be considered as increases in wage rates and subject to the same two effects. Transfer payments, however, usually involve only the income effect, since they do not change the cost of not working under most circumstances.

Wage rates, taxes, and transfer payments all affect labor-force participation. Increased wages (or reduced taxes) draw workers into the labor force, whereas increased transfer payments usually tend to induce workers to leave or stay out of the labor force.

The magnitude of the effects of changes in these factors on income was estimated using regression analyses. These estimates were combined with information on program costs to determine the efficiency of various programs as means of raising family income by $100. The results are shown in the table below.

Changes in marginal tax rates and worker training programs (except for older workers) appear to be the most promising possibilities. Probably the most costly of the programs is government hiring of lower-wage workers at prevailing wage rates.

These comparisons suggest that transfer payments to all families earning $2000 to $3000 per year appear to be an expensive way to raise total income because of the impact of increased transfers on hours worked. On the other hand, transfer payments appear to have little effect on entrance into or exit from the labor force while at the same time incomes of lower-income families are not very responsive to changes in their earnings opportunities. This suggests that programs of increased transfer payments to groups of families with low labor-force

participation rates (e.g., aged) might be combined with programs which tend to increase the earnings of other families.

ANNUAL COST TO THE GOVERNMENT OF RAISING AVERAGE FAMILY INCOMES BY $100 PER YEAR[a]
(1959 data; all families in the $2-3 thousand income class)

Program	Cost, $/year
Education and Training:	
MDTA:	
males 35 to 44	45
males 55 to 64	220
Job Corps, males 18 and 19	80
Head Start	100
Increasing the Demand for Low-Wage Workers:	
Wage subsidies:	- 1
all families	112 - 118
families with earnings only	118 - 130
families with earnings only, over-time subsidy	24 - 46
Direct hiring at prevailing wage rates:	
less than full employment	100
full employment	500 or more
Tax and Transfer Payment:	
Reducing marginal tax rate	70
Increased transfer payments:	
all families	370
families without earnings only	100
families with earnings only	900

a. Costs to the Federal Government include transfer payments and direct outlays (and training costs, where appropriate). Income is measured on a before-tax, after-transfer basis, and includes earnings plus transfer payments (less earnings foregone during the training period). All future income is discounted at a 9 percent rate.

It should be stressed that these estimates are quite crude and reflect average rather than marginal costs--and it is, of course, marginal costs which are relevant for choosing the best combination of programs. The estimates are also based on certain critical assumptions about the responsiveness of lower-income families to wage rates and transfer incomes. Further research is needed on this point but the estimates do give some indication of the relative efficiency of various anti-poverty measures and the kinds of information needed for more conclusive examination.

INTRODUCTION

This Study is an attempt to appraise the efficiency of alternative government programs to increase the incomes of poor families. Although there are no serious conceptual problems, the estimates derived and applied here are rough and tentative because the data available do not permit firm judgment. The comparisons of alternative programs are of some value, however, because they indicate both the approximate magnitude of the costs of different anti-poverty measures and the kinds of information needed for a firmer evaluation.

The effectiveness of alternative programs cannot be assessed without a common yardstick for comparison. The basis for comparison used in this Study is the average annual cost to the government of raising annual average incomes by $100[1] over the working life of the family head (to age 65). Although costs not borne by the government and benefits other than the increase in family income may be relevant to the decision maker, they are not estimated here.

The programs considered fall into three major categories: (1) education and training, (2) measures to increase demand for low-wage workers and (3) tax and transfer payments. But because the last two categories are influenced by many of the same factors and require the same types of analyses for their assessment, they are treated together, and somewhat differently from the first category. Thus, Section 2 evaluates the cost to the government of raising annual family income by $100 through education and training. Section 3 estimates the increases in wage rates and transfer payments, and the

1. Before taxes, after transfer payments.

reductions in marginal tax rates, needed to produce a $100 increase in family income. The government costs of such adjustments in wage rates, transfer payments, and marginal taxes are estimated in Section 4. Alternative programs are compared and conclusions are drawn in Section 5.

2

EDUCATION AND TRAINING PROGRAMS

In most public discussions, education and training programs are evaluated solely on the basis of the number of workers originally unemployed who found jobs at the completion of training. Such evaluation disregards the possibility that many of the unemployed might have found jobs without additional training, while many who found jobs at the completion of their training may lose them subsequently. It also disregards the more important possibility that the declining demand for unskilled workers, which gives rise to training programs, results primarily not in higher rates of unemployment but in lower earnings. If so, the principal effect on the graduates of training programs would be higher earnings rates, not lower unemployment rates. For either possibility, the relevant criterion for judging the benefits of training programs is not the change in unemployment rate but the increase in the worker's future earnings.

Since the initial capital expenditure for education and training programs produces increased earnings over the working life of the trainee, the costs of such programs are not directly comparable to those of transfer payments, which require a certain government expenditure each year to raise annual family income by a certain amount. Comparability of costs between such measures could be achieved either by converting all costs and benefits to their present value through discounting, or by converting all one-time expenditures to an annual stream of (equal) payments. For the purposes of this Study, it is more convenient to choose the latter adjustment. Thus, the analysis here estimates annual increase in income produced by

training[1] and the average annual cost of training spread over the working life of the trainee.[2]

Cost comparisons on an annual basis (or the basis of present value) depend critically on the rate of discount used, which determines which of two cost or benefit streams has the larger present value. Governmental expenditures are frequently evaluated using interest rates as low as 3 to 4 percent per year. Such a rate, it might be argued, is appropriate because it represents the approximate average rate of interest on outstanding government securities. But it does not represent the total cost of these funds to the government. For this Study a discount rate of 9 percent has been used. The reasons for this choice are set forth in Appendix A, Section A1.

2.1 RETURNS TO TRAINING

There is very little evidence regarding the effect of worker training programs on the life-time pattern of earnings. However, some idea of the magnitude of this effect (albeit a very rough one) can be obtained by supposing that workers trained for nine months would achieve an increase in annual earnings equal to that achieved by the average nonfarm male with an additional year of high school education. Of course, many arguments might be advanced to suggest that the increase is either greater or smaller. But, on balance, it seems more likely that the supposition made here will overstate the returns from training (or understate the cost of the benefits of training), especially since there appears to be a distinct correlation between ability and educational attainment at the high school level[3] which this supposition ignores.

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1. The average annual increase in income produced by training is calculated by discounting the future stream of increased earnings to get its present value and then asking what constant increase in annual income discounted would have the same present value.

2. The average annual cost of training is that constant amount per year (to age 65) whose present value equals the capital cost of training.

3. Gary S. Becker, Human Capital (New York: National Bureau of Economic Research, 1964), pp. 124-127.

In 1959 the differential in average annual earnings of nonfarm males attributable to an additional year of education varies from $126 for those in the 18 to 24 age group to $476 for those in the 55 to 64 age group (See Appendix A). In converting this life-time pattern of increased earnings to a present value the increased future earnings were discounted at a rate of around 9 percent per year, and it was assumed that since earnings tend to grow at a rate of about 3 percent per year, the differential earnings attributable to 9 months training would grow by a similar amount over time. On these assumptions, the present value of an additional year's education at age 20 would be about $4,560, and is equivalent to a constant annual earnings increase of $415 for 45 years (i.e., 65 minus 20). The present value of an additional year's education at ages 40 and 60 is about $5,640 and $2,050, respectively, and these are equivalent to constant annual earnings increases of $564 and $513 (until age 65). Since older workers have fewer years of labor-force participation remaining, it is not surprising to find that the present value of additional training would be smaller for them. That additional education is worth more in present value to workers 40 years old than to workers 20 years old results from the fact that the differential earnings associated with increased education increases with age. When discounted, the present value of additional earnings at, say, 50 years is greater for a worker presently 40 than for a 20 year old worker; the fact that the younger worker has more remaining years in the labor force is not sufficient to counterbalance differential earnings for older workers because the present value of the additional earnings twenty-five years hence is only about one-fifth the nominal value at that time (at a 9 percent discount rate).

It is even more difficult to form a judgment about the possible effect of the Head Start Program. As reported by Gaylord (in an unpublished memorandum), in the Murphysboro Early Training Project operated experimentally by Peabody College, the average mental age of disadvantaged children who participated for two years showed an increase of 9 months over non-participants who were similarly disadvantaged. It is not known whether this gain will be sustained after the children enter elementary school. But assuming that

participation in the program results in an additional year's high school completed, participants would receive annual additional earnings of about $415.

Also relevant in evaluating the benefits of an education or training program to a family head is the income foregone (if any) during the training period. For Head Start it is zero. For adult trainees expected earnings were crudely calculated by the method described in Appendix A. For the Job Corps trainee allowances exceed expected earnings by $675. For MDTA expected earnings are greater than allowances by $1495 for men 35 to 44 years old and by $1205 for men 55 to 64 years old. Converting these capital sums to equivalent annual amounts yields an addition of $60 per year to the benefits of the Job Corps, and a reduction of $150 and $300 a year in the benefits of MDTA to trainees 35 to 44 and 55 to 64 years old, respectively.[4]

2.2 COSTS TO GOVERNMENT

The cost to the government of additional training equals expenditures per man under the programs, with expenditures for durable items such as buildings and equipment amortized. In 1964, expenditure per trainee per 9 months in the Job Corps averaged $4,500, including amortization of buildings and equipment and trainee compensation. Converted to 1959 prices, this equals $4,185. As stated earlier, 9 months additional training is roughly estimated to be the equivalent of an annual earnings increase of $415, trainee allowances exceed foregone earnings by an amount equal to $60 per year, so that Job Corps training costs about $880 per $100 annual earnings increase. The appropriate discount factor for converting this capital sum into an annual cost equivalent if borne uniformly for 45 years is 11.0.[5] Hence the annual costs to the government per $100 annual earnings increase in the Job Corps would appear to be roughly $80.

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4. The estimates of foregone earnings may be high if the opportunities of the trainees are not as high as the average for the comparable age and education group.

5. See Appendix A for description of how discount factors were calculated.

According to the Department of Labor,[6] in 1963 the average cost per trainee under the Manpower Development and Training Act was $1,356, of which 52 percent represented trainee allowances. The average duration of training was 26½ weeks. Converting to 1959 prices, the costs per 9 months were $1,895. For workers aged 35 to 44 the estimated increase in annual earnings from a year's training is $564, foregone earnings exceed allowances by an amount equal to $150 annually, so the cost per $100 increased annual earnings is $458, or, with a discount factor of 10, about $45 on an annual basis. For workers aged 55 to 64, however, the discount factor is 4, and $890 per $100 increase in annual earnings ($1,895 divided by 215) implies an annual cost of slightly over $220.

Currently the Office of Economic Opportunity expects to spend $1,000 per 9 months participation per child in the Head Start Program, or about $1,850 for two school years in 1959 prices. These costs are incurred about 10 years before participants would enter the labor force and must be accumulated at interest until that time. At around 9 percent per year, the accumulated value of costs incurred at time of entrance into the labor force would be around $4,540. If Head Start results in one year of additional high school, the latter is equivalent to a capital cost of $1,090 per $100 increase in annual earnings or, using a discount factor of 11, an annual cost of just under $100 per year.

Table 1 summarizes these estimated of the costs to the government of raising family incomes $100 annually. The figures for MDTA and the Job Corps could be changed appreciably by variations in estimates of foregone earnings or in trainee allowances (which account for about half the government costs of these two programs). The relative costs of alternative programs might also change if given to possible reductions in government expenditures on other transfer payment programs, e.g., unemployment insurance, when these people receive trainee allowances.

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6. U.S. Department of Labor, Manpower Research and Training, Report of the Secretary of Labor (Washington, D. C.: U.S. Government Printing Office, 1965) pp. 10-11.

All of these training programs, particularly for pre-school children and younger workers, would cost less per dollar of additional income if future income is discounted at a lower rate than the 9 percent rate used in these calculations.

Estimates discussed in Appendix A indicate that for the Job Corps, but not for MDTA, trainee allowances exceed what the trainee could expect to earn had he remained in the labor force instead of undergoing training. This may indicate that the Job Corps costs could be reduced without having undesirable effects on the number of applicants for training.

Table 1

APPROXIMATE AVERAGE ANNUAL COST TO THE GOVERNMENT OF RAISING FAMILY INCOME $100 PER YEAR

MDTA	
males 35-44	$ 45
males 55-64	220
Job Corps - males 18 and 19	80
Head Start	100

The costs shown in Table 1 are not the only costs that may be relevant to a decision maker. No consideration has been given to the impact of the increased earning power on future government tax revenues or transfer payments. Nor have other external effects been considered. Increased earning power for family heads may have a significant impact on the skills and attitudes acquired by their children. Head Start may reduce the number of problem children in classrooms and thus improve the quality of education received by others. It might also affect future juvenile delinquency rates. All these factors are relevant, but quantification at this time is not possible. Better estimates of the effects of these programs on earning power are also necessary for more precise evaluation.

DIRECT MEASURES TO INCREASE FAMILY INCOME: THE EFFECT OF CHANGES IN WAGE RATES, TRANSFER PAYMENTS, AND TAXES

The education and training programs evaluated in Section 2 eventually and indirectly bring about increases in family income. But there are more direct measures to raise family income--by inducing changes in wage rates, or by increasing transfer payments or reducing taxes. These measures are the subject of this and the next Section. This Section estimates the magnitude of the changes in wage rates, transfer payments, and taxes necessary to increase family income by a given amount. Section 4 estimates the cost of these measures to the Federal Government.

3.1 THE DETERMINANTS OF FAMILY INCOME[1]

In a purely arithmetic sense, family income is determined by the number of hours worked by family members, their hourly rate of earnings, and their non-earnings income (including both income from property, whether received as dividend, interest, or rental payments, and so-called transfer payments).[2] The number of hours worked by family members in a given period, however, are not predetermined but are influenced by their hourly earnings possibilities and their non-earnings income. While the number of hours a person might work at any given time is limited by the availability of jobs, the kinds of jobs employers offer are, in the long run, influenced by the number of hours and the wage rates at which potential workers wish to work.

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1. The formal mathematical model underlying this discussion is presented in Appendix B.

2. Certain types of transfer payments, social security payments and payments under private pension schemes, for example, may be determined by past earnings.

Of course, the hourly earnings opportunities of a given worker may be substantially influenced by his past education and training. Non-earnings income (for example from the ownership of property) is likewise determined to an important extent by its past earnings. But factors such as these are given by the past decisions of the family members; for the analysis of government programs to raise family incomes through wage or tax rate or transfer payments changes, these factors will be assumed constant. In addition, one element of non-earnings income--transfer income--is, under the present system, influenced to a great extent by a family's income from earnings and property. In the discussion that follows, any reduction in governmental transfer payments which accompanies an increase in the family's earning or property income is treated as a positive tax.

In his now famous article, Lionel Robbins[3] was the first to point out that an increase in a worker's hourly earnings rate has two effects on the number of hours he wishes to work. First, an increase in wage rates increases the opportunity cost of time spent not working, or leisure. This effect is analogous to the pure substitution effect of a price change in the theory of consumer demand. Considered alone, it suggests that the worker will consume less leisure (or work longer hours) and consume more commodities purchased on the market with money income, since the cost of commodities has decreased relative to the cost of leisure. But an increase in wage rates also increases the total money income a worker could receive if he worked precisely the same number of hours as before the change; thus his overall well-being has certainly improved, and he could be expected to consume more of most, though not necessarily all, commodities--including leisure. This second effect of a wage change is called the income effect; its influence is opposite to that of the substitution effect, and by itself it tends to reduce the time spent working.

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3. Lionel Robbins, "On the Elasticity of Demand for Income in Terms of Effort," Economica, (June, 1930), pp. 123-129.

Thus, whether higher wage rates available to family members will increase or decrease their hours worked, and whether family earnings will then increase in the same ratio as the increase in wage rates, depend on which effect is dominant. The strength of the income effect, however, varies directly with the fraction of a family's total income received from earnings. At the extreme, if a family's entire income was from sources other than earnings, an increase in wage rates would have no income effect whatsoever: If no family member has a job, the increase in wages does nothing to increase the family's earnings unless some family member is induced to find a job. In fact, lower-income family heads do spend less time working on the average than those of higher-income families,[4] so that one might expect the fraction of income from earnings to vary directly with the household's income level.[5] The income effect of a wage change would then be weaker with respect to the substitution effect among lower-income households and their earnings response to a wage increase would be relatively greater than for higher-income households.

An increase in non-earnings income, like an increase in wage rates, has an income effect on hours worked. By working the same number of hours as before the change, a worker can achieve a greater money income But there is no offsetting substitution effect because a change in other income does not usually alter the opportunity cost of leisure time. For this reason, an increase in property or transfer income would be expected to reduce hours worked for lower-income families than for higher income families. A given increase in transfer payments will increase the total income of poor families by a greater percentage than of higher-income families; if the income elasticity of hours worked is constant across income classes, the increased transfer income would result in a larger proportionate reduction of hours worked by members of poor families. Also, as poor families receive a smaller proportion

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4. U.S. Bureau of the Census, United States Census Population, 1960: Families, Final Report PC(2)-4A (Washington, D.C.: U.S. Government Printing Office, 1963).

5. This appears to be the case, as demonstrated in the following section.

of their income from earnings, a given percentage increase in income would also result in a larger proportionate reduction in hours worked.

Apart from its effects upon the earnings of families who had working members prior to the wage change, a rise in wages may draw into the labor force some members of families previously without earnings (since the substitution effect is always positive and, for a family without earnings, the income effect of a wage change is zero). Furthermore, for family members already in the labor force, an increase in their own potential earnings can only make labor-force participation more attractive.[6] An increase in the earnings of the family head, however, may lead some secondary workers (wives or teenage children) to withdraw from the labor force. The calculations in the following section assume that all the family's earnings are received by a single earner. This assumption is made partly for simplicity and partly because there is no information on the fraction of family earnings accounted for by primary and secondary workers respectively. With this assumption, an increase in wage rates cannot reduce the fraction of families with earnings.

An increase in non-earnings income affects labor-force participation--understood here as the fraction of families with earnings--in much the same way that it affects hours worked. An increase in income will tend to increase the value of leisure as compared with money

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6. Now, it might be objected at this point that with a rise in wage rates there might be a short-run reduction in labor-force participation if workers enter and leave the labor force more frequently. Indeed, most data on labor-force participation refer to whether or not an individual worked at all during a given week, so that the increase in measured labor-force participation with a rise in wages might well be smaller than the increase in the fraction of individuals who did some work during a longer period such as a year. It seems far more sensible to consider such a short-run reduction, however, as a decline in hours worked annually. For, there seems to be little point to enshrining shortcomings in the available data in theoretical constructs.

Because of the above-noted short-run effect, however, most estimates of labor-force participation rates are probably biased downwards. The latter bias tends to offset the upward bias in cross-section studies which results from the migration of persons who tend to work longer hours annually, and hence are reported to be in the labor force more frequently, to areas where wage rates are above average.

income at the margin. The increased value of leisure will lead all workers to work fewer hours, and some to leave the labor force.

The average earnings of any group of families is the product of the fraction with earnings and the average earnings of families with earnings. The average earnings of all families in a given group tends to rise with an increase in wages because the earnings for families with earnings and the fraction of families with earnings both increase. If the increase in the fraction of families who have earnings is large enough to offset any reduction in hours worked that may accompany the rise in wages, the percentage increase in average earnings per family will exceed the percentage increase in wage rates. An increase in non-earnings income, however, will tend to reduce the average earnings of all families in the group, both by reducing the average earnings of families with earnings and by reducing the fraction of families with some earnings.

The effect of a change in the overall unemployment rate on the average earnings of a group of families can also be separated into its effect on the number of hours worked by families with earnings and the fraction of families with some earnings. Typically, in a recession, money wage rates tend not to fall (i.e., to be "inflexible downward")[7] and the use of labor by the economy tends to decline. This decline is manifested partly by lay-offs and partly by a reduction in the average hours worked per week by workers who are still employed. Both of these effects tend to reduce the average annual hours worked per family with labor-force participants.[8] But labor-force participation itself may be affected by higher unemployment rates. Secondary workers may be induced into the labor force because the primary earner of their family is unemployed, a phenomenon called the "added-worker effect" in the literature. Such families, of course, remain families with labor-force

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7. Prices, too, seem to be relatively inflexible downward under such conditions, so as a first approximation it will be assumed that real wages remain constant.

8. On the basis of annual data, families with earnings can only be distinguished from those with labor-force participants for those cases where the head was unemployed for the whole year. The distinction is neglected here.

participants in the sense in which the term is used here. However, some workers may become discouraged and withdraw from the labor force and some of these might have found jobs had they continued to look for them. Thus, an increase in unemployment rates resulting from the so-called discouraged-worker effect tends unambiguously to reduce the average earnings of families by reducing the fraction of families with labor-force participants. Of course, an increase in the overall unemployment rate may be accompanied by a reduction in a family's income from property. This effect can be expected to be small for lower-income families, however, and is neglected here.

In addition to the factors noted already, the responsiveness of a family's income to earnings opportunities and to non-earnings income is influenced purely arithmetically by the relative importance of earnings in its total income. It has already been pointed out that the smaller the share of earnings in total income the smaller the income effect of a given percentage wage increase and, consequently, the greater will be the relative increase in earnings. But on the other hand, the smaller the earnings relative to a family's total income, the smaller the relative increase in its earnings. For this reason, even though its earnings may be more responsive to a given relative increase in wage rates, the total income of a lower-income family may be relatively less responsive than that of a family with a greater fraction of its income from earnings. Similarly, while the earnings of a lower-income family may fall more sharply for a given relative increase in other income, the greater relative importance of non-earnings income could imply a greater relative increase in its total income.

The important factors in determining a family's behavior are wage rates and after-tax income. The taxes referred to include not only payments under Federal, state, or local personal income-tax legislation and payroll deductions for social security insurance, but any systematic reduction in after-tax income which accompanies a before-tax increase. Under most social security and public assistance programs, benefits are geared to the recipient's earnings and other, non-transfer, income;

an increase in earnings, perhaps only after a certain level is reached, is typically accompanied by a reduction in benefits under these programs.[9] The net effect on the income opportunities open to a family is precisely the same as if these benefits had remained unchanged but its Federal income tax liability had increased by the same amount. In addition, the employer's contribution to social security should be included both in the worker's before-tax earnings and his taxes, because the incidence of social security payroll taxes is the same whether collected from the worker or his employer and falls primarily on the worker.

So long as the marginal tax rate remains constant the relative increase in the wage rate or in other income is the same after taxes as before. For example, with a 20-percent tax rate, a before-tax hourly wage of $1.50 yields an after-tax wage of $1.20. If the before-tax wage is increased by $0.25, or one-sixth, and if the marginal tax rate remains at 20 percent, the after-tax wage is raised by $0.20, or one-sixth. Were all forms of income taxed at the same marginal rate (an assumption which is certainly not literally true but is made here for simplicity) then a reduction in the marginal tax rate would increase income from earnings and other income by equal proportions when both were examined after taxes. Thus, a given reduction in marginal tax rates is equivalent in its effect on income after taxes to some equi-proportional increase in wage rates and non-earnings income.

In short, a family's income can be understood as being determined by the earnings opportunities of its members, its non-earnings income,

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9. Under social security, however, an increase in property income does not result in a reduction in benefits, a fact neglected here since it seems unlikely that property income is of substantial importance for lower-income families. The increase in rental which families in public housing must pay whenever their income increases, and their eventual eviction from public housing if their incomes rise far enough, are other examples of reductions in transfer payments which act like increased tax payments. They are omitted from the calculations in the following section, however, because the data were not readily available in the necessary form.

and the marginal rate at which its income from all sources is taxed. Since an increase in earning possibilities or other income permits an increase in money income if all family members work the same number hours as before the change, the family is clearly better off and may be expected to "consume" more leisure time or to work fewer hours and earn less on this account. The greater the relative importance of the income source being changed, the larger the income effect of the family's change in opportunities on the family's total income. In the case of a change in wage rates, however, leisure time becomes more expensive relative to commodities purchased on the market with money income; on this account alone one would expect the hours worked by family members and its total earnings to increase. Since a reduction in the marginal tax rate tends to increase both wage rates and other income after-tax, its effects on the family's income after tax can be determined by analogy with the effects of wage and other income changes.

3.2 ESTIMATES OF THE CHANGE IN FAMILY INCOME

Using regression analyses, Census information on the composition of families by income class, and certain key assumptions, it is possible to estimate quantitative values for the relationships described in Section 3.1. The Census data and the regressions run are described in detail in Appendix B along with a precise description of how they were used to obtain the estimates presented here. The reader interested in methodology as well as results should read Appendix B (and C) before proceeding.

Table 2 indicates the predicted percentage change in average earnings of families with heads in the labor force, given a percentage change in hourly wage rates, transfer payments, or the unemployment rate.[10] If a change in wage rates had no net effect on hours worked then there would be a one-to-one relationship between the percentage

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10. The percentage change in average earnings does not equal the percentage change in average income unless income from sources other than earnings is zero.

change in wage rates and the percentage change in earnings. If increased transfer payments did not result in fewer hours worked, that elasticity would be zero. The estimates on Table 2 are made on the assumption that the income and substitution elasticities of hours worked are the same for all income classes. The variance between income classes results from the different fraction of total income from earnings. This fraction tends to rise somewhat with income class, but the variations are not large. Table 2 suggests a declining numerical response with income class of average family earnings to wage rates and changes in non-earnings income. For wage changes, even in the lowest income class the coefficient is only about 15 percent larger than that for the average of all income classes, but the estimates imply that in the lowest income class average annual earnings of families with earnings are about twice as responsive to changes in non-earnings income as for the average of all income classes.

Table 2

ESTIMATED RESPONSIVENESS OF AVERAGE EARNINGS, FAMILIES WITH EARNINGS, BY INCOME CLASS

Income Class, thousands of 1959 $'s	Fraction of Income from Earnings[a] (1)	Elasticity of Average Earnings with Respect to		
		Wage Rates[b] (2)	Non-earnings Income[b] (3)	Unemployment Rate[b] (4)
Total	.85	.70	-.15	-.10
1	.72	.80	-.31	-.11
1-2	.73	.79	-.30	-.11
2-3	.78	.75	-.23	-.11
3-4	.83	.71	-.17	-.10
4-5	.85	.70	-.15	-.10

a. See Appendix B.
b. The wage rate elasticity is the quantity b_1 (in Appendix B, Section B2), non-earnings income is b_2, and the unemployment rate is b_3.

Table 3 shows similar estimates for the response of average income of all families, including both those with and those without earnings, by income class. There is far greater variation among income classes in the fraction of income from earnings for all families, shown in the first column of Table 3, than for families with earnings only, previously shown in Table 2. The difference is accounted for by the increase in the fraction of families with earnings as income increases. The elasticity of average income with respect to wage rates, non-earnings income, or unemployment rates is the sum of the effect on families with earnings plus the effect on labor-force participation. The estimates assume that persons entering or leaving the labor force have the same annual earnings as the average.

Table 3

ESTIMATED RESPONSIVENESS OF AVERAGE INCOME, ALL FAMILIES, BY INCOME CLASS

Income Class, thousands of 1959 $'s	Fraction of Income from Earnings[a] (1)	Elasticity of Average Income (all Families) with Respect to		
		Wage Rates[b] (2)	Non-earnings Income[b] (3)	Unemployment Rate[b] (4)
Total	.80	.64	.050	-.12
1	.37	.34	.50	-.060
1-2	.44	.39	.42	-.070
2-3	.61	.52	.23	-.098
3-4	.75	.61	.10	-.11
4-5	.81	.65	.044	-.12

a. See Appendix B.
b. The wage rate elasticity is the quantity d_1 (in Appendix B, Section B2); non-earnings income is d_2, and the unemployment rate is d_3.

Column 2 of Table 3 indicates that, despite the somewhat greater responsiveness of average annual earnings for families with earnings to wage rates in the lower income classes, the responsiveness of their total income to wage changes is much smaller because the fraction of

their income from earnings is so much smaller. Thus, while a 10 percent increase in wage rates would lead to about a 6.5 percent increase in total family income on the average for all income classes (if the estimates in Table 3 are correct), the increase for families with incomes less than $2,000 would be less than 4 percent. With respect to other income changes, however, the responsiveness is far greater in the lowest income classes than for the average family, again despite the relatively greater reduction in average annual earnings for families with earnings shown in Table 2. Finally, note that because of the variation in the fraction of income from earnings shown in column 1, the elasticity of total family income with respect to the unemployment rate shown in column 4 is only half as great for families with income under one thousand dollars per year as for the average of all families.

The elasticities presented on Tables 2 and 3 along with information on the average income for each income class[11] can be used to estimate the percentage change in wage rates necessary to produce a $100 increase in family income for each income class.[12]

Table 4 presents the results of estimating this relationship, column 1 shows the estimated fraction by which hourly earning rates would have to rise if the average income of all families in a given income class were to increase by $100 per year. The required increase in earnings declines drastically from almots two-thirds in the lowest income class to 7 percent in the $2-3 thousand class. Columns 2 and 3 show that, for families with incomes less than $3 thousand per year, increased earnings opportunities would have a far greater impact upon families with earnings than those without earnings. Increased earning opportunities would benefit families without earnings

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11. See Appendix B, Section B2.

12. These estimates are made holding non-earnings income constant. If government transfer payments are reduced when earnings rise then the percentage change in wage rates specified on Table 3 will raise families income by less than $100. The net cost to the government will also be less.

only to the extent that one or more of their members were induced to obtain jobs, and the effect of increased earnings upon labor-force participation appears to be small.

Table 4

EFFECTS IN TOTAL INCOME OF INCREASED WAGE RATES[a]

Income Class, thousands of 1959 $'s	Relative Increase in Wage Rates Required to Increase Average Annual Income to all Families by $100[b] (1)	Increase in Annual Income, $	
		Families with Earnings (2)	Families without Earnings (3)
Total	.020	96	144
1	.64	190	23
1-2	.15	140	31
2-3	.070	110	63
3-4	.042	93	200
4-5	.031	90	500

a. See Appendix C for precise description of estimating method, p.
b. This $100 is a weighted average of the resulting increase in income for families with and those without earnings (see discussion of this Table in Section C1 of Appendix C).

While increased earnings opportunities would appear to have relatively little effect upon the incomes of many lower-income families, a policy of increasing income through transfer payments would appear substantially to reduce the earnings of recipient families who already have earnings. Table 5 shows estimates of the average increase in total family income by income class which would result from an increase in transfer payments of $100 per family. As seen from Column 1 the absolute increase in average total family income would be relatively high in the lowest income class but declines rapidly for successively higher income classes. For a family without any earnings, of course, an increase in other income would have no leakage through reduced earnings; for families with earnings, however, an increase in income other than earnings would lead family members to work fewer

hours and, though less important quantitatively, to withdraw from the labor force. Table 5 indicates the effect of greater non-earnings income, on the assumption that families regard a dollar of transfer income as equivalent in producing additional satisfaction to a dollar of earnings. Over 80 percent of the increased income from transfer payments would be offset by a reduction in the earnings of families with earnings. Because the fraction of families with earnings increases with income class, earnings reduction induced by transfer payments become quantitatively more important in their effects on the average income of all families in the higher income classes.

Table 5

EFFECTS ON TOTAL INCOME OF INCREASED TRANSFER PAYMENTS[a]

Income Class, thousands of 1959 $'s	Increase in Total Income per $100 Transfer Payment per Family, $'s			Transfers Required to Increase Avg. Incomes of all Families by $100
	All Families (1)	With Earnings (2)	Without Earnings (3)	(4)
Total	11	3.0	100	940
1	61	16	100	160
1-2	47	16	100	210
2-3	27	11	100	370
3-4	14	8.3	100	700
4-5	2.3	--	100	4,400

a. See discussion of this Table in Section C1 of Appendix C.

Thus, increased earnings opportunities would appear to have relatively little effect upon the incomes of many lower-income families because their members do not hold jobs or are not readily induced to obtain them by higher wage rates, and increased non-earnings income might well induce a substantial reduction in the earnings of families whose members already have jobs. One way out of this apparent dilemma would be to restrict the payment of increased transfers to families without earnings. This would forfeit only the additional earnings of families who would have been induced into the labor force by the

prospect of higher earnings but do not seek jobs because of their increased other incomes. The effect upon the incomes of families in the lower-income groups of earnings increases operating though increased labor-force participation seems relatively small.

Table 6 illustrates the effect of a specially designed wage increase. Column 1 shows the estimate of the relative increase in earnings opportunities which would be needed to increase the average total income of families with earnings by $100. For the income classes less than $3,000 these increases are all smaller than those required to raise the average total incomes of all families by the same amount (Table 3). Even so, in the lowest income classes the required increase is still quite large. The increases shown in column 2 are "compensated" in the sense that the wage increase is effected in such a way that by working precisely the same number of hours as before, the family's total income would be exactly the same as before the increase (for example, by payment of overtime rates or by reducing non-earnings income concommitantly). A wage increase effected in this way avoids the reduction in hours worked due to the income effect. As Table 6 shows, the earnings increases required to raise income by $100 are about six times as large when the income effect is at work (column 1) than when it has been eliminated (column 2).

Many writers regard a reduction in the overall unemployment rate as important in combatting poverty. Table 7 presents the results of evaluating the importance of this factor. It shows the increase in average total income[13] which would result from a reduction of the overall unemployment rate from 5.5 percent (the rate which prevailed in 1959) to 3.7 percent (the average rate for the three preceding cyclical peak years 1948, 1953, and 1957). Note that the absolute income increases tend to increase with income class and are relatively small for poor families. These estimates agree with the conclusion presented

13. Earnings are the only component of income that is assumed to vary with the unemployment rate. Property income is not likely to be important for low-income groups.

Table 6

EFFECTS ON TOTAL INCOME OF INCREASED WAGE RATES[a]
(Families with Earnings Only)

Income Class, thousands of 1959 $'s	Relative Increase in Wage Rates Required to Raise Total Income by $100	
	Straight (1)	Compensated[b] (2)
Total	.021	.0035
1	.34	.064
1-2	.11	.020
2-3	.065	.011
3-4	.046	.00 6
4-5	.034	.0056

a. See discussion of this Table in Section C1 of Appendix C.
b. If affected in such a way that if all workers were to work precisely the same number of hours as before the change in total family income would remain unchanged.

Table 7

EFFECTS ON TOTAL INCOME OF A REDUCTION IN THE UNEMPLOYMENT RATE FROM 5.5 PERCENT TO 3.7 PERCENT[a,b]

Income Class, thousands of 1959 $'s	Increase in Total Income, $		
	All Families	Families with Earnings	Families without Earnings
Total	300	220	1,300
1	9.1	13	5.3
1-2	38	41	33
2-3	88	74	150
3-4	140	100	690
4-5	200	140	2,500

a. The rate of 5.5 percent is the 1959 rate; 3.7 percent is the average rate for cyclical peak years 1948, 1953, and 1957.
b. See discussion of the Table in Section C1 of Appendix C.

elsewhere,[14] namely, that higner unemployment rates in recent years account for a relatively small part of the poverty problem. Of course, these estimates neglect both the possible impact of higher unemployment rates on the rate of growth of wages and the effect of prolonged unemployment on the skills acquired by the labor force.[15]

The final influence on family income to be discussed here is taxation. The marginal tax rate in column 1 of Table 8 consists of the additional taxes paid (including any reduction in transfer payments received) per dollar of additional income before taxes and transfer payments. It was calculated from unpublished (and unofficial) tabulations for the Office of Tax Analysis, U.S. Department of the Treasury, of data contained in the 1960-61 BLS, USDA Survey of Consumer Expenditures. The marginal tax rates paid by families in the $2-4 thousand income range exceed those paid by families with average incomes.[16] The calculations shown in Column 2 (based upon Column 1 and Eq. 9 of Appendix B, Section B1) suggest that by reducing marginal tax rates in the $2-4 thousand income range by around 2 to 3 percentage points, after-tax incomes would rise by an amount equivalent to a before-tax, after-transfer increase of $100. Alternatively, by reducing the marginal rate in the $3-4 income range to 21 percent, the rate which prevails in the income class corresponding to the average incomes of all families, after-tax family income would rise by an amount equivalent to a before-tax, after-transfer increase of almost $900.

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14. Richard F. Muth, Comparison of Alternative Methods of Projecting the Poverty Rate, Institute for Defense Analyses, Economic and Political Studies Division, IDA Research Paper P-276 (Arlington, Va.), in preparation.

15. Since high unemployment rates hit teenagers particularly hard, and if the skills and attitudes of adults are influenced by their work experience as teenagers then prolonged high unemployment may lead over time to a relatively less productive adult population.

16. From similar calculations not shown, this is true all the way up to the range above incomes of $10 thousand per year.

Table 8

EFFECTS ON TOTAL INCOME OF CHANGES IN MARGINAL TAX RATES[a]

Income Class, thousands of 1959 $'s	Marginal Tax Rate[b] (1)	Change in Marginal Tax Rate Required to Increase Income[c] by $100 (2)	Change in Taxes, $ (3)
Total	.21	-.014	-111
1-2	.072	-.064	- 52
2-3	.27	-.032	- 72
3-4	.38	-.020	- 77
4-5	.17	-.022	-113

a. See discussion of this Table in Section C1 of Appendix C.

b. Includes reductions in transfer payments. Data are derived from unpublished tabulations from 1960-61 BLS, USDA Survey of Consumer Expenditures. Taxes paid refer solely to personal income taxes and payroll taxes, while transfer payments consist only of money payments--various pension programs, including social security, unemployment compensation, and public assistance, primarily. For reasons noted earlier in the text, an estimate of the employer's contribution to OASI was included both in income before taxes and in taxes paid. Additional taxes paid, used in calculating the figures in the first column, include reductions in transfer payments received. The marginal rates shown and used to obtain the other columns are those applicable to increases in income. In these tabulations, all income recipients with incomes below $2 thousand were shown as a single class, so the below $1 thousand class was omitted here. The rate shown for total families is that for the income class in which the average income for all families falls.

c. More precisely, the amount required to raise income after taxes and transfer payments by an amount which is the same as the family receives after taxes from a before-tax, after-transfer increase of $100.

4

THE FEDERAL COST OF DIRECT MEASURES TO INCREASE FAMILY INCOME

4.1 THE COST OF ADJUSTMENTS IN TRANSFER PAYMENTS AND TAXES

The annual cost to the government of raising the incomes of low-income families by a given amount through increased transfer payments or reduced marginal tax rates has already been roughly estimated in the discussion in Section 3. Since, as argued there, an increase in non-earnings income tends to reduce the hours worked by members of a family (and even induces some to withdraw from the labor force), more than $100 in transfer payments is required to raise income by $100. Estimates of the required increases in transfer payments were shown by income class in Column 4 of Table 5 and ranged from $160 for the lowest income class to $370 for the $2-3 thousand class.[1] These estimates assume that, on the average, households in a given income class respond in exactly the same way to an increase in income, notwithstanding differences among income classes in the fraction of their income from earnings.

It will be argued later that anti-poverty measures other than increases in transfer payments are likely to prove to be considerably cheaper. On the other hand, it was shown in Section 3 that, because of the relative insensitivity of labor-force participation to hourly earnings rates, policies designed to increase the earnings of poor family members will have relatively little effect upon the incomes of families who have no earnings currently. For this reason it would seem desirable to increase the incomes of poor families without

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1. The annual cost would be even higher in the higher income classes, but presumably the anti-poverty program is directed primarily at the three lowest income classes.

earnings through increased transfer payments. Transfer payments to such families would suffer no leakages in the form of reduced hours worked or withdrawal from the labor force; thus, $100 of additional transfer payments would raise before-tax income by $100. In order to achieve this lower cost, it would, of course, be necessary to identify families who would have little or no income from earnings in the absence of the program. However, since such families are frequently those with, say, aged, female and/or disabled heads, it would seem relatively easy to identify them on the basis of objective criteria.[2]

The Federal cost of adjustments in the marginal tax rate as a measure to increase after-tax incomes of families is the taxes lost by such a reduction. Column 2 of Table 8 showed the reduction in the marginal tax rate required to increase the after-tax incomes of families by the same amount they would net from a before-tax, after-transfer increase of $100. Column 3 showed the taxes lost by such a cut,[3] which run from about $50 per family in the lowest income class to slightly less than $80 in the $3-4 thousand class. Since marginal tax rates applicable to the $2-4 thousand income classes are higher than those paid by all except the very highest income families, reduction of these marginal rates would seem especially desirable. Since the marginal rates paid now by families with incomes below $2,000 are already quite low, possibilities for raising income here by reducing marginal rates are limited. But as will become apparent later, there appears to be few anti-poverty measures that can achieve a $100 increase in before-tax income more efficiently than tax reduction in this income class.

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2. An undesirable side effect of such a program, including female heads of households, might be to encourage family desertion by fathers so the family could qualify for transfer payments.

3. In the absence of any good information on the fraction of non-earnings income subject to tax, the figures shown in the last column of Table 10 assume that all such income is taxable. Most transfer payments, however, are not taxable, so the last column tends to underestimate the taxes lost, both absolutely and in the lower relative to the higher income groups.

It should be re-emphasized that in this Study any reduction in transfer payments that accompanies an increase in earnings or in income from property is treated as a positive tax. Thus, in addition to reducing marginal tax rates under the Federal personal income tax, the marginal tax rate relevant for this analysis would also be reduced by eliminating provisions of Federal welfare and income-maintenance programs under which benefits are contingent upon earnings or property income falling below a certain level. The increased expenditure under these programs if such provisions were eliminated is included in the loss of taxes. Examples of such changes in welfare rules are payment of social security benefits once a certain age is reached or allowances to families with female and/or disabled heads who have children irrespective of their incomes from other sources.

The preceding discussion provides a convenient framework in which to examine briefly the possible effects of several tax proposals recently advanced. One of these proposals, put forward nearly every time reform of the Federal tax system is discussed, is to increase the level of exemptions for Federal income tax purposes. By doing so the marginal tax rate applicable to lower-income families would certainly be reduced. However, all families now paying a positive tax would also receive a tax reduction and, because marginal Federal income tax rates rise with income, benefits to higher-income families would be greater than for poor ones. For this reason, and because it would be relatively costly, raising exemptions would not seem to be a very efficient anti-poverty weapon.

Another suggestion is to pay to a family the amount by which its income falls short of its exemptions (and perhaps its Federal deductions). For example, a family of four (without aged or blind members) with an income of $1,800 would receive a payment of $600. Under this plan the marginal tax rate on income from earnings would be 100 percent up to the family's deductions. As a result, no member of a family whose earnings would otherwise be less than the value of the family's deductions--this group includes most members of families considered poor under current criteria--would have any incentive to earn any income at

all. Thus, this plan would also be a relatively costly one for increasing the after-tax incomes of low-income families with labor-force participants.

The foregoing plan is a special case of the so-called negative income tax, under which, if a family's income were to fall below a certain amount determined in part by family size, the age of its head, and perhaps other factors, the family would receive a fraction of the difference between this amount and its income. The negative income tax by itself would increase transfer income to low-income families. It would also impose an additional tax on income from earnings and property, since with any increase in its earnings or property income the difference between its zero tax income level and its income before tax would decline; its negative tax would thus be reduced. However, if the negative income tax were adopted as a substitute for present transfer-payment programs, either directly or indirectly by requiring that benefits received under present programs be deducted from the negative tax payment, the marginal tax rate for the recipients of benefits received under present programs would probably be reduced. The negative-income tax has much to recommend it in terms of administrative simplicity. However, because it increases both transfer income and marginal tax rates to low-income families, it would probably lead to reduced income from earnings if made applicable to families with earnings. It could therefore be a relatively costly plan for the government to use in trying to raise the incomes of poor families with earnings.

4.2 THE COST OF INCREASING EARNING POWER

There are essentially two ways to raise earning power: by increasing the skills of workers through education and training, and thus the earnings they can command (as discussed previously), or by increasing the demand for low-wage workers of given skills. Apart from measures to maintain full employment, other ways to increase the latter demand for low-wage workers include a wage-subsidy program to increase private demand and direct hiring of low-wage workers by the government.

The precise cost of these measures to the government depends upon the elasticities of demand and supply for lower-wage workers. For example, if demand were perfectly elastic and the supply schedule perfectly inelastic, then the increased earnings of the group considered would be exactly equal to the subsidies paid by the government. But if the supply of labor had a positive elasticity, the higher wages resulting from the subsidy would induce a higher proportion of workers in the group to seek jobs or to work longer hours (or both). As a result, the increased earnings of a group would exceed the expenditures made by the government. Although the elasticity of labor supply would appear to be slightly negative (since the effect of the reduction in hours worked by workers employed prior to a wage increase would tend to exceed the effect of increased labor-force participation) it is rather close to zero. The precise value of the elasticity of demand for low-income labor is not known, but one would expect it to be no smaller numerically than the elasticity of demand for labor in the economy as a whole, about -3.3 as discussed in Section B2 of Appendix B. But since low-wage labor is only a small part of the total labor hired by the economy, its demand might tend to be much larger numerically, say minus infinity, depending upon the substitutability of low-wage for other workers.

With these values of demand elasticity and the values of labor supply elasticity implicit in Tables 2 and 3, limits on the cost to the government of increasing earnings through wage subsidies can be established using the formula described in Appendix C. If the subsidy were made applicable to all families, whether or not they would have any earnings in the absence of the subsidy, the cost to the government would be between $112 and $118 per $100 increase in earnings before tax for families in the $2-3 thousand class, slightly less in the lower income class and slightly more in the higher. If, however, the subsidy scheme were to be devised so as to apply only to families who would have some earnings in its absence, the cost would be between $118 and $133 per $100 increase in average earnings in the $2-3 thousand class. The higher cost results from the fact that in the second case there

would be no increase in earnings resulting from increased labor-force participation. As noted previously, though, the benefit received from higher earnings possibilities by lower-income families who would otherwise be without earnings would tend to be small.

Finally, if a wage subsidy scheme could be devised that would avoid the income effect of higher wage rates on hours worked, as, for example, where overtime rates are paid, the labor supply elasticity would appear to be large and positive. As described more fully in Appendix C, by avoiding income effects (so that hours worked by members of families who would have some earnings in the absence of the subsidy would increase rather than decrease) the cost to the government would be between $24 and $46 per $100 increase in average earnings. This type of plan would appear to be one of the cheapest considered in this section for raising incomes of poor families if, indeed, a practical way to implement it could be devised. One possibility is to offer workers in low-income families an income tax refund on any earnings greater than a certain level. Earnings for this purpose might be taken as the worker's average earnings in, say, the past three years when the scheme is first instituted and would then be gradually revised.

The cost to the government of hiring workers at wage rates prevailing in the market also depends upon the elasticities of labor demand and supply. Of course, if the workers hired would otherwise have been unemployed, then the cost to the government of raising their earnings by $100 is simply the amount spent or $100. If full employment prevailed, however, workers would have to be bid away from other employers. If the demand for the class of workers hired on the latter's part were highly elastic, then the government would merely replace private employers with no appreciable increase in the earnings of the workers hired. In fact, from the calculations described more fully in Appendix C, it would appear that this method of trying to raise earnings would be quite expensive, costing around $500 or more per $100 increase in average earnings.

5

COMPARISON OF PROGRAMS

Table 9 summarizes the estimated costs to the government of raising the average income of families in the $2-3 thousand per year bracket by $100. Increased transfer payments to the group as a whole appear to be an expensive method of raising total income because of the negative impact of increased transfers on hours worked. According to the crude estimates made in this Study the elasticity of hours worked with respect to increased transfer payments is -.15. However, the impact of transfer payments on entrance into or exit from the labor force appears minimal. But since incomes of lower-income families without earnings are not very responsive to changes in their earning opportunities, measures to increase earning power will have little effect on many lower-income families. For this reason it might be desirable to combine programs of increased transfer payments for families whose labor-force praticipation rates are low with measures which seek to increase the earnings of other families.

Among the measures to increase earnings, the cheapest appears to be a program of wage subsidies designed so that a worker's income would be precisely the same if he were to work the same number of hours as in the absence of the subsidy. A program of wage subsidies not so designed would be more expensive because the empirical evidence indicates that few new workers would be attracted into the labor force, while those already working would reduce their hours worked. (The estimated elasticity of hours worked with respect to wage rate changes was -.30.) Depending upon the elasticity of the market demand for low-wage workers, a "compensated" wage subsidy would cost the government between $24 and $46 per $100 increase in earnings generated. Such schemes, however, might be quite difficult to devise and enforce so their total cost might actually be considerably higher.

Table 9

ANNUAL COST TO THE GOVERNMENT OF RAISING AVERAGE FAMILY INCOMES BY $100 PER YEAR[a]
(1959 data; all families in the $2-3 thousand income class)

Program	Cost, $/year
Education and Training:	
MDTA:	
males 35 to 44	45
males 55 to 64	220
Job Corps, males 18 and 19	80
Head Start	100
Increasing the Demand for Low-Wage Workers:	
Wage subsidies:	
all families	112 - 118
families with earnings only	118 - 130
families with earnings only, overtime subsidy	24 - 46
Direct hiring at prevailing wage rates:	
less than full employment	100
full employment	500 or more
Tax and Transfer Payment:	
Reducing marginal tax rate	70
Increased transfer payments:	
all families	370
families without earnings only	100
families with earnings only	900

a. Costs to the Federal Government include transfer payments and direct outlays (and training costs, where appropriate). Income is measured on a before-tax, after-transfer basis, and includes earnings plus transfer payments (less earnings foregone during the training period). All future income is discounted at a 9 per cent rate.

The next most promising possibilities would appear to be reduction in the marginal tax rates faced by lower-income families and worker training programs. By reducing marginal tax rates, the government could, at a cost of approximately $70 raise the after-tax incomes of lower-income families by an amount which is the same as that yielded by a before-tax, after-transfer increase in income of $100. The

estimates given here of the cost of raising annual earnings by $100 through training programs range from about $45 per year under Manpower Act programs for middle aged workers to nearly $80 per year for the Job Corps. These estimates were made on the assumption that 9 months of training would yield the same average increase in annual earnings as an additional year of schooling at the high school level. Because it would appear that more able persons acquire additional education at the high school level, the annual earnings increase for those completing worker training programs might in fact be smaller. Moreover, no allowances are made for "drop-outs" in the calculations. For both reasons, the actual costs might turn out to be higher than those quoted in Table 9. On the other hand training programs may have a greater impact on attitudes and aspirations than an additional year of high school. Further research on the incremental annual earnings that participants in worker training programs might receive would be extremely valuable in making finer appraisals of the costs of such programs. Probably the most costly of the programs examined is that of government hiring of lower-wage workers at prevailing market wage rates, at least if full employment prevails. While in the years just past many such workers might have been otherwise unemployed, under full-employment conditions such workers must be bid away from private employers or new workers induced into the labor force by higher market wage rates. If the private demand for such workers is highly elastic, such a program would merely replace private with public employment with little change in either average hourly earnings or employment of this group.

Finally, it should be stressed again that the above estimates are quite crude in many instances and, at best, reflect average rather than marginal costs. It is the latter, of course, which are relevant for choosing the best set and combination of anti-poverty measures. Also the estimates here reflect the assumption that the response of low-income families to changes in wage and transfer income is the same as that of other income groups except for the fact that earnings form a different percentage of their total income. Further research into the responses of low-income families is necessary before firmer

estimates can be made. The estimates should be helpful, however, because they indicate both the approximate efficiency of various anti-poverty measures and the kinds of information relevant for a more thorough examination. In addition, the analysis of the determination of a family's total income should prove useful for examining the effects of other measures not considered explicitly here.

Appendix A

THE FEDERAL COST OF EDUCATION AND TRAINING

Appendix A

THE FEDERAL COST OF EDUCATION AND TRAINING

This appendix discusses in detail the calculation of the cost to the government of raising earnings through education and training programs. It discusses first the opportunity cost to the government of borrowed funds, which is the relevant interest rate to use in converting capital sums to annual payment streams in order to minimize government costs. The discount factors used to transform lump sum costs into cost per year are then calculated, after which follows a discussion of the problem of estimating the present value of the incremental income stream which results from an education and training program. Finally, foregone earnings are compared with trainee allowances.

A.1 APPROPRIATE DISCOUNT RATE

The use of a discount rate higher than 3 or 4 percent in evaluating government programs is frequently justified on the basis of the opportunity cost of those funds to society. The rate used is some estimate of the rate of return to society if those funds were utilized by the private sector instead. Since the focus of this study has been on minimizing costs to the government, not necessarily to society, the opportunity cost of these funds to the government are calculated instead.[1]

The opportunity cost of borrowed funds to the government includes not just the interest it must pay, but also the taxes it would have collected on funds withdrawn from the private sector. Since consumption appears to be virtually a constant fraction of permanent

1. Admittedly it may be more appropriate for a government decision-maker to focus on social not just government costs.

disposable income, government borrowing is not likely to alter consumption expenditure unless it changes permanent income. If the government borrows to finance worker training or other capital-type expenditures, the future stream of payments lenders would have received from the private sector is replaced by an equivalent stream from the government. The future disposable incomes of taxpayers are reduced by the future taxes required to pay interest and repay the principal borrowed by the government. Taxpayers may not take the whole of this future tax liability into account in their consumption decisions. But the reduction in disposable income is somewhat offset because the borrowed funds are used for training programs which can be expected to raise the future disposable incomes of lower-income households. There is thus no clear presumption that on the average the permanent disposable incomes of households decreases. Rather, the borrowing is essentially a method of transferring future income from taxpayers generally to current lower-income households.

For this reason, the most important alternative use for resources withdrawn from the private sector by government borrowing is private capital formation. The latter produces income, a part of which flows to the government in the form of corporate income taxes and another part in the form of personal income taxes. Capital in the non-corporate sector, essentially agriculture and residential real estate, of course, is exempted from payment of corporate income taxes, while the income from owner-occupied residential real estate, which is currently about 60 percent of total residential real estate, is exempt from personal income taxation.

In order to estimate the taxes lost through the withdrawal of resources from the private sector by government borrowing, it is therefore necessary to know the distribution, among the different sectors defined by the Federal tax system, of the private capital which would have been formed by these resources. Because there is little information on the marginal distribution of private capital formation among these sectors, it is here assumed to be equal to the current average distribution among the three relevant sectors--

residential real estate, agriculture, and corporate (i.e., all others). The actual distribution assumed for this study, based upon net capital income for the year 1957, is shown in Table A-1.

Table A-1

ESTIMATES OF NET CAPITAL INCOME
(AFTER DEPRECIATION AND PROPERTY TAXES),
BY SECTOR, 1957

Sector	Net Income[a], billions of $	Percent of total
Residential Real Estate	17,300	23.2
Agriculture	8,290	11.1
Total Non-Corporate	25,590	34.3
Corporate (all others)	49,089	65.7
Total	74,679	100.0

[a]For all except residential real estate, income is defined as national income originating less labor income for the sector. For residential real estate income is gross space rent less unpublished Office of Business Economics estimates of property taxes paid and depreciation (net income for residential real estate was deducted from the real estate industry included in the corporate sector). Other data from U.S.Office of Business Economics, U.S. Income and Output (Washington, D. C.: U.S. Government Printing Office, 1958).

In order to complete the estimate of the tax receipts lost by government borrowing, it is necessary to know the following additional factors: the rate of interest on government bonds, the rate of return to private capital, and the marginal taxes rates applicable for corporate and personal-income taxation. In recent years the yield on long-term government bonds has averaged around 4 percent per year. Recently, Stigler[2] has estimated that the rate of return to capital in manufacturing has averaged about 7 percent per year. It seems most

1. George J. Stigler, Capital and Rates of Return in Manufacturing (Princeton, New Jersey: Princeton University Press, 1963).

likely that the majority of the income from capital subject to Federal taxation is received by persons in the upper income groups; in an unpublished project working paper it was shown that the marginal tax rate for that income group is around 30 percent (1/3 is used here). Finally, a marginal corporate income tax rate of one-half seems to be as precise as necessary in view of the approximate nature of the other figures used.

The total opportunity cost to the government of borrowing is shown in Table A-2. Since interest payments on government debt are taxed at an assumed marginal rate of one-third, the net borrowing rate is about 2.7 percent per year. A dollar's worth of corporate capital yields about 7 cents of corporate income taxes per year under the conditions assumed, and, since a little less than two-thirds of a dollar borrowed would have gone into corporate sector capital, about 4.6 percent is the rate of corporate taxes lost by a dollar's borrowing. Finally, not quite seven-eighths of the borrowed dollar would have produced capital whose income would be subject to personal income taxation. With a marginal tax rate of one-third and a net return of 7 percent per year the taxes lost per dollar of capital whose income is personal income taxable is 2.3 cents, so personal income taxes lost amount to about 2 percent. All told, then, the opportunity cost of borrowed funds to the government is about 9.3 percent per year, which corresponds to a discount rate for continuous compounding of 8.9 percent per year.

It should be noted that the social opportunity cost (not just the government cost) of funds borrowed by the government probably exceeds 9 percent. If about one-third of the borrowed dollar earns a gross return of 7 percent per year (since its income is not subject to corporate taxation), while two-thirds earns a gross return of 14 percent, then the income in the private sector given up is about 11.6 cents per borrowed dollar. The higher rate is the more appropriate one for judging the efficiency of resource use in the economy.

Table A-2

CALCULATION OF OPPORTUNITY COST TO GOVERNMENT OF BORROWED FUNDS

Item	Cost, %	Basis	
Net borrowing cost	2.67	Government borrowing rate . . .	0.0400
		less: personal income taxes collected on interest payments at marginal tax rate of 1/3	-0.0133
			0.0267
Corporate taxes cost	4.60	Return per $ of capital in corporate sector	0.140[a]
		times: marginal corporate tax rate	X0.5
			0.070
		times: fraction of net capital income from corporate sector	X0.657
			0.0460
Personal income taxes cost	1.99	Return on capital net of corporate taxes in private sector	0.0700[b]
		times: marginal tax for personal income taxes	X0.033
			0.0231
		times: fraction of personal income from capital that is taxable	X0.8610
			0.0199
Total opportunity cost of borrowed funds, net borrowing cost plus taxes cost	9.26	Sum of above	

[a]Before corporate tax return corresponding to Stigler's (op. cit.) estimate of net return after corporate tax of about 7 percent and marginal corporate income tax rate of about 50 percent.

[b]Estimate from Stigler, op. cit.

A.2 DISCOUNT FACTORS APPLIED TO CAPITAL SUMS

Using the opportunity cost to the government described above, Table A-3 shows the calculation of the discount factor to be used for converting capital sums into annual payment streams. With a discount rate of 9 percent per year, the correction for the finite life of the payment stream--the term $e^{-.089L(T)}$--is of practical importance only for streams whose duration is 25 years or less. For an infinite stream, for example, the discount factor would be about 11.2.

Table A-3

DISCOUNT FACTORS APPLICABLE FOR CONVERTING CAPITAL VALUES INTO EQUAL ANNUAL PAYMENT RATES TO AGE 65, BY PRESENT AGE

T, Age in Years	L(T) = 65-T	$e^{-.089L(T)}$	$C(T) = \frac{1}{.089}(1-e^{-.089L(T)})$
20	45	.018	11.0
40	25	.108	10.0
60	5	.641	4.0

A.3 INCREASED INCOME PRODUCED BY EDUCATION AND TRAINING

As a rough basis for comparing such anti-poverty programs, it seems sensible to suppose that a year (really nine months) in such a program generates the same additional earning power as an additional year of formal education at the high school level. If trainees were uniformly distributed between 8 and 11 years of educational attainment, then the appropriate value of the annual earning increment would be one-third the difference between the earnings associated with 9 and 12 years of education. In the absence of the needed information, the value used here is one-fourth the difference between 8 and 12 years. But, as Table A-4 indicates, not only earnings received at any point in time, but also the difference in earnings per additional year of schooling vary with the worker's age. Therefore, as illustrated in

Table A-5 for workers who are 40 years old at the completion of their training, the incremental income stream was first converted to its present value. For this purpose it was assumed that the annual increment shown in the last column is constant in the time interval (T_1, T_2) so that

$$V = \int_{40}^{65} [\Delta(wL)\ (t)]e^{-pt}\ dt \qquad (1)$$

$$= \sum_{T_1 < 65} \Delta(wL)\ (T_1,T_2) \int_{T_1}^{T_2} e^{-pt}\ dt$$

$$= \sum_{T_1 < 65} \frac{\Delta(wL)\ (T_1,T_2)}{p}\ (e^{-pT_1} - e^{-pT_2}) \quad .$$

Of course, the differential received by a given worker might be expected to widen over time as earnings increase. This shift was allowed for, however, by deducting from the discount rate an allowance for earnings increase over time of 3 percent per year, the approximate rate in recent years. The p substituted into Figure 1 was therefore 0.059. The present value for a 40 year old worker shown in Table A-5, $5.638, was then converted to its constant annual equivalent $564 using the discount factor of 10.0 from Table A-4.

Table A-4

INCREASE IN AVERAGE ANNUAL EARNINGS WITH HIGH SCHOOL EDUCATION[a]
(Nonfarm males, by age, 1959 data)

Age, years	Average Annual Earnings, $		
	8 years of Elementary School	4 years of High School	Difference Per year
18-24	2,590	3,094	126
25-34	4,335	5,446	278
35-44	4,909	6,511	400
45-54	5,119	6,844	431
55-64	5,108	7,010	476

[a]Source: Calculated from data in [12].

Table A-5

ILLUSTRATIVE CALCULATION OF PRESENT VALUE OF INCREMENT
TO ANNUAL EARNING STREAM
(40 year-old worker)

At Age T_1 =	Δ(wh) Increment to Annual Earnings dollars [a]	$e^{-.059T_1}$	$\delta(T_1)$ = $p^{-.059T_1} - e^{-.059T_2}$ (see note b)	$V(T_1) = \frac{\Delta wL}{.059}\,\delta(T_1)$
40	400	1	.255	1,729
45	431	.745	.332	2,424
55	476	.413	.184	1,486
65		.229		

$$V = \sum_{T_1 < 65} V(T_1) = \quad 5,638$$

[a]From Table A-4.
[b]T_2 is the next T_1 below the entry in this column.

A.4 FOREGONE EARNINGS OF TRAINEES

In Section 2.2 it is suggested that a comparison of trainee allowances with expected earnings might indicate whether the costs to the government of a particular program could be reduced. Table A-6 presents estimates developed in this study of the earnings foregone by workers while in training. Workers trained by the Job Corps were assumed to be 18 to 19 years old with 1 to 3 years of high school, while those trained under the Manpower Development and Training Act would be from the occupational group "laborers, except farm and mine." The average annual earnings for the group so defined were first multiplied by one minus the unemployment rate for the group in 1959 to make rough allowance for the fact that some of the trainees would have been unemployed had they not undergone training.[3] This figure was then multiplied by three-fourths to reflect the assumed length of training, which is 9 months. It is interesting to note that the estimate of foregone earnings so obtained for Job Corps trainees is only about two-thirds of what they received in allowances and benefits in 1964, while those for the other two groups is about twice the rate of trainee allowances actually paid to Manpower Act trainees.

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3. Estimated earnings are overstated if trainees had higher unemployment rates than their peer group.

Table A-6

ESTIMATION OF FOREGONE ANNUAL EARNINGS SELECTED GROUPS OF MALES, 1959

Group	Average Earnings Nonfarm Experienced Workers, $[a]	Adjustment Factor for Unemployment[b]	Foregone Earnings, $[c]
Age 18-19 years,[d] 1 to 3 years of high school	2,561	.649	1,630
Age 35-44 laborers, except farm & mine	3,765	.931	2,480
Age 55-64 laborers, except farm & mine	3,338	.876	2,190

[a]Calculated from data in U.S. Bureau of the Census, United States Census of Population, 1960; Occupation by Earnings and Education, Final Report PC(2)-7B (Washington, D. C.: U.S. Government Printing Office, 1963).

[b]One minus the group unemployment rate from U.S. Department of Labor, Statistical Tables on Manpower (Washington, D. C.: U.S. Government Printing Office, 1965). Since for occupation the unemployment rate is not broken down by sex, the rate for both sexes was used for the latter two groups. This particular occupational group, however, consists mostly of males.

[c]First column times second column times 0.75.

[d]The average earnings figure used is for all males with 1 to 3 years of high school who were 18-24 years old. It seems too that the average earnings of 18-19 year olds would be smaller.

Appendix B

DETERMINATION OF FAMILY INCOME

Appendix B

DETERMINATION OF FAMILY INCOME

B.1 The Model

The mathematical treatment of the model of average family income presented below employs the following notation:

y = total personal family income (y' refers to families with some earnings only, y'' to families without earnings).

y_L = total family income from earnings

y_0 = total family non-earnings income (income from property plus transfer income).

f_L = fraction of income from earnings.

f_0 = fraction of income from non-earnings ($f_L + f_0 = 1$).

g_0' = fraction of total non-earnings income received by families with some earnings.

g_0'' = fraction of total non-earnings income received by families without earnings ($g_0' + g_0'' = 1$).

g = as a subscript refers to gross of taxes

h = number of hours worked by family members per unit time

L = number of hours of leisure of family member per unit time

ℓ = fraction of families with earnings

n = as a subscript refers to net of taxes

t = marginal tax rate (treating transfer payments as negative taxes)

u = overall unemployment rate

w = average hourly earnings of family members

$*$ indicates natural logarithm.

B.1.1 Families with Earnings

For families with earnings, the percentage change in average total income equals the weighted average of the percentage change in income from earnings and income from other sources:

$$dy'^{*} = f_L^1 \, dy_L^{1*} + f_0^1 \, dy_0^{1*} \qquad (1)$$

The percentage change in income from earnings depends on the change in wage rate and the change in hours:

$$dy_L'^{*} = dh^{*} + dw^{*} \qquad (2)$$

Assume

$$dh^{*} = a_1 dw^{*} + a_2 dy'^{*} + a_3 du^{*} \qquad (3)$$

which may be interpreted as a family's supply schedule of hours worked. As discussed in Section 3.1, it seems reasonable to assume that the family's demand for leisure has a positive income elasticity, or that $a_2 < 0$. In addition, since an increase in w increases the price of leisure relative to that of commodities purchased on the market $a_1 > 0$. The last term of Eq. 1 refers to the short-run disequilibrium effect of an increase in the overall unemployment rate, and presumably $a_3 < 0$.

Substituting Eqs. 2 and 3 into Fig. 1 yields

$$dy_L'^{*} = b_1 \, dw^{*} + b_2 \, dy_0'^{*} + b_3 \, du^{*} \; ; \qquad (4)$$

where

$$b_1 = \frac{1 + a_1}{1 - f_L' a_2} > 0,$$

$$b_2 = \frac{f_0' \, a_2}{1 - f_L' a_2} < 0, \text{ and}$$

$$b_3 = \frac{a_3}{1 - f_L' a_2} < 0.$$

The coefficient b_1 is greater than or less than unity depending upon whether the substitution effect on hours worked of an increase in hourly earnings is numerically larger than the income effect. Note, too, that all the b's are numerically smaller the larger f_L'. The latter results from the fact that the greater f_L', the greater the income effect of a change in wages (or, in the short-run, employment opportunities) and the smaller the effect on y' of an increase in y_0'.[1]

B.1.2 Families Without Earnings

Let

$$d\ell^* = c_1\, dw^* + c_2\, dy_0^* + c_3\, du^* , \tag{5}$$

where $c_1 > 0$ and $c_2 < 0$ as described in Section 3.1, while $c_3 < 0$ since only the discouraged worker effect is included.

Since $$dy_0 = \ell dy_0' + (1-\ell)\, dy_0'' ,$$

$$dy_0^* = g_0'\, dy_0'^* + g_0''\, dy_0''^*; \tag{6}$$

and substituting Eq. 6 into Eq. 5 yields

$$d\ell^* = c_1\, dw^* + g_0'\, c_2\, dy_0'^* + g_0''\, c_2\, dy_0''^* + c_3\, du^*. \tag{7}$$

---

1. It might well be argued that the a's themselves are numerically smaller the larger f_L'. For, if

$$dL^* = \alpha_1\, dw^* + \alpha_2\, dy'^* + \alpha_3\, du^*,$$

where $(\alpha_1 < 0, \alpha_2 > 0, \alpha_3 > 0)$,

and

$$dL + dh = 0 \text{ or } dh^* = -\frac{L d^*}{h},$$

then

$$dh^* = -\frac{L}{h}\alpha_1\, dw^* - \frac{L}{h}\alpha_2\, dy'^* - \frac{L}{h}\alpha_3\, du^*.$$

If the α's were the same for all families and, as seems likely, f_L' varied inversely with $\frac{L}{h}$, then $a_i = (-L/h)\,\alpha_i$ would tend to be numerically smaller the greater f_L'. But because data on hours worked by income class is not available no attempt is made here to introduce the considerations mentioned in this footnote into the calculations presented in the body of this paper.

B.1.3 All Families, Average Income

Now, $dy^* = f_L\, dy_L^* + f_0\, dy_0^*$ and

$dy_L^* = dl^* + dy_L'^*$;

thus,

$$dy^* = d_1\, dw^* + d_2'\, dy_0'^* + d_2''\, dy_0''^* + d_3\, du^*, \qquad (8)$$

where

$$d_1 = f_L\ (b_1 + c_1)' > 0,$$

$$d_2' = f_L\, b_2 + g_0'\ [1-f_L(1-c_2)] < g_0',$$

$$d_2'' = g_0''\ [1-f_L\ (1-c_2)] < g_0'', \text{ and}$$

$$d_3 = f_L\ (b_3 + c_3) < 0.$$

If

$$dy_0'^* = dy_0''^*,$$

$$dy_0^* = (g_0' + g_0'')\, dy_0'^* = dy_0'^*,$$

and the middle two terms of the right number of Eq. 8 are replaced by $d_2\, dy_0^*$

where

$$d_2 = 1 - f_L\ (1-b_2 - c_2) < 1.$$

Thus, with an equi-proportional increase in the other income of all families the hours of work for those with earners decline and some families who previously had them cease to have earners. For this reason, the elasticity of the average income of families with respect to their other income is certainly less than unity. The coefficient d_1 may be either greater than or less than f_L; the latter will be true if the elasticity of hours worked is sufficiently negative that the effect on earnings of the reduction in hours worked outweighs that of increased labor force participation. Finally, d_3 will tend to be negative since the added worker effect, even though it may exceed the discouraged worker effect as labor-force participation is usually understood, is not included in it in the present definition of l, while both the discouraged worker effect and the change in average hours worked annually with increasing u tend to reduce earnings.

So far, the effect of taxes has been neglected. What is relevant, of course, for a family's decisions about whether or not its members shall work and, if so, how long is income after taxes under the various alternatives open to it. Since

$$dw_n^* = d[(1-t) \times w_g]^* = d(1-t)^* + dw_g^*,$$

and similarly for the y_o's and y, then

$$dy_n^* = d_1\, dw_g^* + d_2'\, dy_{0,g}'^* + d_2''\, dy_{0,g}''^* + d_3 du^* - \left(\frac{d_1 + d_2}{1-t}\right) dt. \quad (9)$$

By estimating the coefficients d_1, d_2, and d_3 the change in wage, tax, transfer payment or unemployment rate necessary to produce a given change in average family income can be calculated.

B.2 ESTIMATION OF COEFFICIENTS

The information necessary to estimate the coefficients d_1, d_2, and d_3 is specified in the expressions below equation (8). It includes

(1) f_L, g_0', g_0''

(2) b_1, b_2 and b_3

(3) c_1, c_2, and c_3

Also necessary is information on t, the marginal tax rate given on Table 7, p 23.

B.2.1 f_L, g_0', and g_0''

The fraction of income from earnings (f_L), the fraction of total non-earnings income received by families with some earnings (g_0') and the fraction of total non-earnings income received by families without earnings ($g_0'' = 1 - g_0'$), all by income class, were calculated from 1960 Census data adjusted by information from the Office of Business Economics, U. S. National Income Accounts.

Table B1 shows the composition of personal income payments for the nation as a whole for the year, 1959, from the National Income Accounts. The income from unincorporated business is not earnings

attributable solely to labor but includes elements of property income as well. Except for agricultural, where only about one-quarter of such income originates, little is known about the fraction of unincorporated business income attributable to labor alone, and, in any case, there would be no way to separate out labor income from the property element in census data on self employment income. Therefore, it was decided to treat all of unincorporated business or self-employment income as attributable to labor in the calculations made. The national income data then imply a fraction of personal income attributable to labor, or to earnings in the sense relevant for the determination of hours worked and labor force participation, of 80.5 percent.

Census data for the year 1959 for all U.S. families[2], however, imply that 90.1 percent of income is received in the form of wages and salaries or self-employment income. Part of the discrepancy results from a differential under-reporting of earnings and other income. The Bureau of the Census has estimated that its income data for 1959 amounted to about 94 percent of the conceptually comparable total estimated by the Office of Business Economics and over 99 percent of wage and salary income[3], this implies that income from sources other than earnings is less fully reported in the Census tabulations. The discrepancy also arises because the Census data do not include items such as food produced and consumed at home, the net rental value of owner-occupied housing, and certain transfers such as gifts and insurance benefits which are included as personal income in the national income accounts. The items excluded

2. U.S. Bureau of the Census, United States Census of Population, 1960; Sources and Structure of Family Income, Final Report PC(2)-4C (Washington, D. C.: U.S. Government Printing Office, 1964).

3. Ibid, p. XIII.

Table B1

Personal Income by Type of Payment [a]
(1959 data)

Type of Payment	Amount (billions of $'s)	Percent of Total
Wages and salaries	258.5	
Other labor income	10.4	
Total labor income	268.9	68.6
Income of unincorporated business	46.5	11.9
Total earnings	315.4	80.5
Rental income of persons	11.9	
Dividends	13.7	
Personal interest income	23.5	
Total property income	49.1	12.5
Transfer payments	27.5	7.0
Total other income	76.6	19.5
Total personal income	392.0	100.0

a. Source: U.S. National Income Accounts

seem relevant for the purposes of the calculations presented in this paper. Thus, as shown in Table B2, the ratio of earnings to total income for all income classes was multiplied by 0.893, the factor which makes the ratio for all U.S. families agree with the

Table B2

Derivation of Fraction of Income from Earnings by Income Class for Non-Farm Families[a] (1959 Data)

Income Class, thousands of 1959 $'s	Number of Families, thousands	Average Earnings, $'s	Average Other Income, $'s	Fraction of Income from Earnings	
				Census	Corrected [b]
A. All Families					
Total	41,806	6,170	665	.902	.805
<1	1,999	173	239	.419	.374
1-2	2,808	729	763	.488	.436
2-3	3,262	1,690	774	.686	.613
3-4	3,851	2,890	566	.836	.747
4-5	4,616	4,050	414	.907	.810
B. Families with Earnings Only					
Total	38,537	6,690	535	.926	.848
<1	937	369	118	.755	.721
1-2	1,778	1,150	348	.766	.728
2-3	2,674	2,060	413	.832	.783
3-4	3,599	3,090	368	.893	.828
4-5	4,502	4,150	313	.929	.852

a. Source: Computed from data in U.S. Bureau of the Census, United States Census of Population, 1960; Sources and Structure of Family Income, Final Report PC(2)-4C (Washington, D. C.: U.S. Government Printing Office, 1964) Table 7.

b. Preceding column multiplied by 0.793, which is the ratio of fraction of earnings shown in Table B1 to that computed from the above source for all U.S. families.

estimate derived from the national income accounts. There is no reason to believe that the relative discrepancy is the same for all classes of families, of course, but no other information on the discrepancy is available. In any case, the magnitude of this correction is not large.

One other point concerning the estimates of shares of earnings in total income should be noted. What is relevant for determining the income of families is income after taxes. The census data, however, refer to income before taxes but after (most) transfer payments. For this reason the shares of earnings given in Table B2 are probably somewhat high. In consequence, the responses of families to earnings and other income changes presented may be somewhat too large algebraically. This is compensated for, however, in that the estimates of substitution and income elasticities of hours worked described below were also inferred from earnings shares on a before tax but after transfer basis.

When it was necessary to know the magnitude of either non-earnings or total income, as in converting relative to absolute increases or vice versa, the corrected fraction of earnings was divided into Census-reported earnings to obtain corrected total income. Subtracting earnings from the latter yielded an estimate of corrected non-earnings income. Such a procedure, of course, assumes that the whole of the "error" in the census data is in income from sources other than earnings, an assumption which is certainly incorrect but about the only one feasible. The income classes shown in the various tables in this Study refer to census reported income, however, since this is the measure of income in terms of which poverty has come to be judged.

B2.7 b_1, b_2, b_3

The coefficients b_1, b_2 and b_3 for each income class were

estimated by first using regression analysis on Eq. 4 to obtain average estimates of b_1, b_2 and b_3 for all income classes. These average estimates, plus information on the average f_L' and f_o' (= 1 - f_L') for all families were then substituted into the expressions for b_1, b_2 and b_3 below Eq. 4 to obtain values for a_1, a_2 and a_3. Then, on the assumption that a_1, a_2 and a_3 were the same for all income classes, and that differences between income classes were the result only of the fraction of total income from earnings (f_L), the appropriate b values for each income class were calculated.

B2.2.1 The regression estimates of the average b values.

Cross-section data were used to estimate the b values of Eq. 4. Table B3 summarizes the impact on average family earnings of the variables of primary concern here and compares the cross-section results with time-series results.[4]

In the cross-section regression the dependent variable was the median annual earnings of male operatives. The measure of hourly earnings used was a weighted average of hourly earnings of manufacturing workers by two digit industry in a given state relative to the national average hourly earnings in that industry. Property and transfer income were entered as separate variables, and the unemployment rate used was that for males in the state. Various other variables describing the demographic structure of the state's population as well as education and local governmental expenditures, whose coefficients are not shown in Table B3, were included as well.

4. For a more detailed description of the cro s-section regressions see Appendix D.

The elasticity of annual earnings with respect to wage rates found in making comparisons among the 48 conterminous US states for 1959 is -.71. The elasticity of hours worked implied by this estimate is -.29. The latter agrees quite closely with Finegan's[5] estimates, which ranged from -.25 to -.35 for comparisons among different occupational and industrial groups for the U.S. as a whole in 1950. The closeness with which the estimates of this Study from quite different kinds of comparisons agree with his suggests that high confidence in these estimates is justified. The fact that the time series estimate for the U.S. as a whole for 1950-60 in this Study is quite different--the implied elasticity of hours with respect to wage rates is essentially zero--may result from the short time period covered or it may reflect the omission of certain variables which should have been included.

Turning to the other coefficients in Table B3, annual earnings were found to be negatively and significantly associated with both property and transfer income per family. The coefficients are not wholly satisfactory, however. Since property income is about twice as great per family as transfer income, the property-income elasticity should be about twice as great as that of transfer income if families regard the two sources of income as equivalent. Yet, the relation between the two is precisely the reverse. This finding, incidentally, would seem to be inconsistent with the contention of many proponents of welfare programs that recipients of benefits under these programs regard their benefits as worth much less to them than income from earnings or property.

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5. T. Aldrich Finegan, "Hours of Work in the United States: A Cross-Sectional Analysis," Journal of Political Economy, LXX (October 1962) pp. 452-470.

Table B3

LOG-LINEAR REGRESSION ESTIMATES OF THE DETERMINANTS OF ANNUAL EARNINGS

Independent Variable	Cross-Section 48 states, 1959 [a]	Time-Series U.S. total, 1950-60 [b]
Hourly Wage Rates in Manufacturing	.71 (.11)	1.04 (.04)
Property Income/ Family	-.11 (.045)	--
Transfer Income/ Family	-.20 (.10)	--
Other Income/ Family	--	--b
Unemployment Rate	-.086 (.041)	-.053 (.0093)

a. The dependent variable was median annual earnings of male operatives, 1959. An index of hourly earnings by industry in the state relative to the national average, computed from data from the 1957 Census of Manufactures was used to measure wages, while unemployment was measured by the average rate for males in the state. Various other variables, relating primarily to population composition and education were included in the regression equation. For a fuller description see Appendix D.

b. The dependent variable was median wage and salary income of male operatives in constant (1959) dollars. Hourly wages were measured by BLS average hourly earnings in manufacturing, unemployment by total unemployment rate. Other income per family and trend were also tried; the former had a positive coefficient and the latter was highly colinear with wage rates, so both were deleted.

The sum of the property -# and transfer-income coefficients seems absurdly small but the property income coefficient is of the right order of magnitude. The difficulty with the transfer income coefficient probably lies in an upward bias resulting from a tendency for families who prefer shorter hours of work to locate in states where transfer payments are especially high. It should be noted, too, that only positive coefficients were found for other non-earnings income in the time series regression, so that the non-earnings income variable was deleted. Happily, though, the coefficients of the unemployment rate from the two regressions seem to be of about the same order of magnitude.

B.2.2.2 Calculation of the a Values, Using the Regression Estimates of b.

As stated earlier, the regression results for the average b values can be used in the formulas following Eq. 4 to calculate the values of a_1, a_2 and a_3. The values used for b_1 and b_3 were .7 and .1 respectively. The value of b_2 from the cross-section regression seems too high. The sum of the coefficients of property and transfer income per family is about -.3. When this and the value $f_L' = .848$ from Table B2 are substituted into the expression for b_2 given in Section B1, a positive value for a_2 is implied. While a positive value is logically possible, it seems unlikely on empirical grounds. The coefficient (-.1 in Table C3) for property income only, which according to Table B1 is 12.5/19.5 = .641 of other income, implies

$$\frac{.641 \times .152 \times a_2}{1 - .848 \times a_2} = -.1 \quad \text{or} \quad a_2 = -.9.$$

The latter, in turn, implies a value for b_2 of about -.156. Now, because the sum of time spent working and in leisure, or not working, is fixed, the real income demand elasticity for leisure

$= (h/\ell) \times a_2$. Since approximately .6 of the population 14 years old and over work, say, 40 hours per week for 39 weeks per year, $-(h/\ell) \times a_2 = (1560/150) \times -7.9 = .95$. The latter value seems quite reasonable in view of the fact that expenditures for reading and recreation in the U.S. national income accounts have increased about proportionally with disposable income over the cyclical peak years for which data are available, implying an income demand elasticity of about unity. Hence, in all the calculations presented in this Study, an average b_2 value of -.15 has been used.

To complete the information necessary to calculate the a's it is necessary to assign values to f_L' and $f_o' = 1 - .848 = .152$. These values inserted in the b formulas imply $a_1 = +3.3$, $a_2 = -6.0$, and $a_3 = -.61$.

B.2.2.3 Use of a Values to Calculate b Values Different for Each Income Class.

Given these values for a_1, a_2 and a_3 and assuming that these values are constant across income classes, it is possible to insert into the b formulas the f_L' appropriate for each income class, to obtain varying estimates of b_1, b_2 and b_3 for each income class. These are given in column 1 of Table 1, Section 3.

B.2.3 c_1, c_2, c_3

Table B4 compares cross-section and time-series estimates of the coefficients c_1, c_2, and c_3 from Eq. 5 with estimates made by Bowen and Finegan[6]. Although the regression coefficients

6. William G. Bowen, and T. A. Finegan, "Labor Force Participation and Unemployment," Arthur M. Ross, ed., Employment Policy and Labor Market, (Berkeley, Cal.: University of California Press, 1965), 115-61.

Table B4

LOG-LINEAR REGRESSION ESTIMATES OF THE DETERMINANTS OF LABOR-FORCE PARTICIPATION

Independent Variable	Cross-Section 48 states 1959[a]	Time-Series U.S. total, 1950-60[b]	Bowen-Finegan 3 Inter-city, 1959[c]
Earnings	--	.11 (.018)	.079
Transfer Income/ Family	-.022 (.018)	--	--
Other Income/Family	--	--	-.026
Unemployment Rate	-.062 (.0088)	-.065 (.024)	-.041

a. The dependent variable was the fraction of males 14 and over in the labor force. Earnings, which were measured by the series described in Table B3, had a "t" - ratio smaller than unity and was deleted. Property income had a positive coefficient and was deleted. The regression also included other variables as described in Table B3. For a fuller description see Appendix D.

b. The dependent variable was an age-sex specific index of labor-force participation rates, using 1957 population weights. Independent variables are the same as described in Note b of Table 1. Other income and trend had "t" - ratios smaller than unity and were deleted.

c. The coefficients from Bowen and Finegan (op. cit.) in the linear regression were converted to elasticities using average values for non-farm population in 1959. The dependent variable was labor-force participation rate of males 25-54, and annual earnings were used to measure wage rates.

are all highly significant statistically, the relative responses shown by the elasticities are all quite small. An examination of the labor-force participation of males 14 years old or older by state failed to find a coefficient for wage rates or property income which exceeded its standard error, but the coefficient for transfer income per family agreed closely with the value for other computed from the Bowen-Finegan results. In the time-series comparisons presented, the coefficient of non-earnings income per family was actually positive, and this variable was therefore deleted, but the elasticity of labor force participation with respect to hourly earnings in manufacturing is about the same size as found by Bowen-Finegan for their inter-city comparisons. The more detailed review of labor-force participation presented by Fisher[7] leads to about the same conclusions as those coefficients shown in Table 2, namely, while statistically significant responses to earnings and non-earnings income can be discerned for most groups of workers, these responses are rather small in relative terms. Finally, the coefficients found for unemployment rates from the two sets of data are about the same and agree rather well with the elasticity shown in Column 4 of Table 2. In calculations in this study the values used for c's were the combined results of these three estimating methods. They were $c_1 = -.1$, $c_2 = -.03$ and $c_3 = -.05$.

B.2.4 The d Values

The above values for f_L, g_o', g_o'', the b and c coefficients, when substituted into the expressions for the d's following equation 8 give the results summarized in Table 2.

7. Anthony Fisher, Poverty and Labor Force Participation, Institute for Defense Analyses, Economic and Political Studies Division, IDA Research Paper P-273 (Arlington, Virginia), in preparation.

Appendix C

THE FEDERAL COST OF RAISING AVERAGE FAMILY INCOMES BY $100 THROUGH WAGE, TAX, OR TRANSFER PROGRAMS

Appendix C

THE FEDERAL COST OF RAISING AVERAGE FAMILY INCOMES BY $100 THROUGH WAGE, TAX, OR TRANSFER PROGRAMS

This appendix describes the application of the elasticities developed in Appendix B to estimate the dollar cost to the government of increasing family incomes by $100. It describes in detail how each subsequent result described in the text was derived from the previous estimates.

C.1 THE CHANGE IN WAGES, TAXES, TRANSFER OR UNEMPLOYMENT NECESSARY TO RAISE FAMILY INCOME $100

The derivation of the data in the tables in Section 3 dealing with effects on total incomes (Tables 3 through 7) is described below.

Table 3: The percentage change in wage rates necessary to increase average family incomes (all families) by $100 can be calculated from the following formula (notation as in Appendix B):

$$\frac{dW}{W} = \frac{dy}{y} \div \frac{\frac{dy}{y}}{\frac{dw}{w}} \quad , \qquad (2)$$

where

$$\frac{\frac{dy}{y}}{\frac{dw}{w}} = d_1 \text{ and varies depending on the income class,}$$

$dy = \$100$, and

y = average income, all families, for the appropriate income class.

This $100 increase in average family incomes is a weighted average[1] of the increase in incomes of families with earnings and families without earnings. For families with earnings.

$$dy'_L = \frac{dw}{w} \cdot b_1 \cdot Y'_L \quad . \tag{2}$$

For families without earnings

$$dy'' = dy - \ell dy', \text{ where } dy' = dy'_L \quad , \tag{3}$$

since only wage rates have been changed.

Table 4: The increase in total income produced by a $100 increase in transfer payments, is equal to $100 for families without earnings. But it is equal to less than $100 for families with earnings because they reduce their hours worked. For all families together

$$dy = d_2 \cdot y \cdot \frac{dy_o}{y_o} \quad (\text{where } dy_o = \$100). \tag{4}$$

For families with earnings

$$dy' = b_2 \cdot y' \cdot \frac{\$100}{y_o'} \tag{5}$$

The increase in transfers required to increase average income for all families by $100 is

$$dy_o = \frac{\$100 \cdot y_o}{d_2 \cdot y} \quad . \tag{6}$$

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1. See Table B2.

Table 5: The percentage increase in wage rates required to raise family income of those with earnings by $100 can be calculated from

$$\frac{dy'}{y'} = \frac{\frac{dy'_L}{y'_L} \cdot f'_L}{\frac{dw}{w}} \cdot \frac{dw}{w} , \qquad (7)$$

Where

$$\frac{dw}{w} = \frac{\$100}{y'} \cdot \frac{1}{b_1 \cdot f'_L} \cdot$$

If instead of a regular wage increase, the increase is so arranged that if the hours worked remained the same, family income would be constant (a compensated wage increase), then the income effect would be zero, and only the substitution effect would be relevant (a_1 in Eq. 4 of Appendix B).

That is,

$$\frac{dy'}{y'} = \frac{dy'_L}{y'_L} \cdot f'_L = f'_L \left(\frac{dw}{w} + \frac{dh}{h}\right) \qquad (8)$$

$$= f'_L \cdot \frac{dw}{w} (1 + a_1)$$

Thus the required compensated wage change to increase incomes of families with earnings by $100 is

$$\frac{dw}{w} = \frac{\$100}{y' \cdot f'_L (1 + a_1)} \cdot \qquad (9)$$

If the compensated wage change were applied to all families and not just families with earnings, then the required wage change to raise

all families incomes $100 would depend also on the response of labor-force participation:

$$\frac{dw}{w} = \frac{\$100}{y \cdot f_L (1 + a_1 + c_1)} \quad . \tag{10}$$

Table 6: The dollar increase in income for all families that would be produced by a reduction in the unemployment rate from 5.5 percent to 3.7 percent would be

$$dy = d_3 \cdot y \cdot \frac{du}{u} \quad . \tag{11}$$

For families with earnings

$$dy' = b_3 f_L' \cdot y_L' \cdot \frac{du}{u} \quad . \tag{12}$$

For families without earnings

$$dy'' = \frac{dy - dy' \cdot \quad}{1 -} \quad . \tag{13}$$

Table 7: To compare the cost of increasing family incomes by $100 through tax reductions with the cost through wage increases it is first necessary to adjust for the fact that the $100 wage increase is taxable. It is necessary to calculate the change in marginal tax rates required to increase family income by an amount after taxes equal to $100 on a pre-tax, post-transfer basis. This amount can be calculated by subtracting the marginal tax rate times $100 from the $100 figure. The change in the marginal tax rate required to increase income by this amount can then be

calculated from the following formula:

$$-dt = \frac{dy_n}{y_n} \cdot \frac{(1-t)}{(d_1+d_2)} \qquad (14)$$

Estimates of y_n by income class were obtained by applying ratios (by income class) calculated from the 1960-61 BLS-USDA Survey of Consumer Expenditures to the corrected Census total income data described in Section 32 of Appendix B.

Where only earnings and not transfer payments were taxed, the required change in the tax rate would be larger.

$$-dt = \frac{dy_n}{y_n} \frac{(1-t)}{(d_1)} \qquad (15)$$

To obtain the change in taxes collected (T) as a result of dt, the following equation was used:

$$dT = tdy_g + y_g dt.$$

If taxes apply only to earnings the appropriate equation would be

$$dT = tdy_{Lg} + y_{Lg} dt. \qquad (16)$$

C2. The cost to the government of raising family income $100.

The cost to the government of raising family incomes through increased transfer payments or reduced tax rates can be read from Tables 4 and 7, respectively. Column 4 of Table 4 shows, by income groups, the increase in transfer payments necessary to raise family income by $100. These amounts are the full costs to the government. Column 3 of Table 7 shows the taxes lost to the government as a result of adjusting marginal tax rates to increase family income by $100.

The remainder of this Appendix discusses the costs of the government of wage subsidies and direct hiring as measures to increase the demand for lower-wage workers.

Wage subsidy schemes might be implemented either in the form of a bonus paid to the employer or as a tax rebate to the worker. The discussion of these means of implementation will require the following notation, in addition to any used above.

S = the amount of the subsidy.

S_0 = The amount of the subsidy paid at the previous market equilibrium wage, w_0, for the class of workers considered.

s = reduction in the subsidy per dollar increase in the market wage net of the subsidy.

L_s = Man hours of labor supplied.

L_D = Man hours of labor demanded.

l_s = Slope of the labor supply schedule.

l_D = Slope of the labor demand schedule.

E_s = Elasticity of the labor supply schedule.

E_D = Elasticity of the labor demand schedule.

w_m = The maximum wage at which a subsidy is paid.

Y_L = Total wages paid inclusive of the subsidy.

C = Total subsidy payments.

Suppose that the subsidy payment is made a fraction of the difference between some maximum wage rate and the prevailing wage net of the subsidy, or $S = s\,(w_m - w)$ for $w \leq w_m$. Then

$$dS = s\,(w_m - w_0 - dw) = d\,S_0 - s\,dw, \text{ where } S_0 = s\,(w_m - w_0). \tag{17}$$

The change in the quantities of labor supplies and demanded are

$$dL_s = l_s\,(dw + dS) = l_s\,(1-s)\,dw + l_s dS_0 \text{ and} \tag{18}$$

$$dL_0 = l_D dw. \tag{19}$$

In the new equilibrium, quantity supplied must equal quantity demanded, so

$$dw = \frac{-l_s}{[l_s(1-s)-l_D]} \qquad dS_0 = -\frac{E_s}{[E_s(1-s)-E_D]}\, dS_0\,, \tag{20}$$

and

$$dL = \frac{-E_D E_S}{[E_S(1-2\_-E_D]} \qquad \left(\frac{L\,dS_0}{w}\right) \tag{21}$$

The change in total wages paid out, inclusive of the subsidy, is

$$dY_L = L(dw + ds) + wdL = \frac{-E_D\,(1 + E_s)}{[E_s(1-s) - E_D]}\,(LdS_0)\,. \tag{22}$$

The cost to the government, its total subsidy payments, is $C = SxL$ and

$$dC = SdL + LdS = L\,(dS_0 - s\,dw) = \frac{E_S - E_D}{[E_s\,(1-s) - E_D]}\,(LdS_0)\,, \tag{23}$$

evaluating at $S = 0$, which is appropriate for considering the effects of instituting a subsidy. The cost of the subsidy per

dollar's increase in total wages paid inclusive of the subsidy is then

$$\frac{dC}{dY_L} = \frac{E_s - E_D}{-E_D(1 + E_s)} \xrightarrow{E_D \to -\infty} \frac{1}{1+E_s} , \qquad (24)$$

and is independent of s. By differentiating Eq. 24 it becomes clear that 1) for $E_D < -1$, the cost to the government is smaller the greater E_s, and 2) the cost to the government is smaller (greater) the greater is the labor demand elasticity if $E_s > 0$ ($-1 < E_s < 0$).

It seems reasonable to expect that the elasticity of market demand for lower-wage manhours is at least as great numerically as that for labor in the economy as a whole. The latter denoted by E_D' can be evaluated using the formula developed by Hicks,[2]

$$E_D' = -\left(\frac{\sigma + k_L E_c}{1 - k_L}\right) , \qquad (25)$$

where σ is the elasticity of substitution of labor for capital in the economy as a whole, k_L the fraction of national income (at factor cost) paid out to labor, and E_c is the elasticity of supply of capital to the economy as a whole. Now, various studies have indicated that the log-linear production function in labor and capital, for which $\sigma = 1$, gives a close approximation to U.S. output data, while from the national income accounts it would appear

2. John R. Hicks, The Theory of Wages (New York: Peter Smith, 1948), Appendix pp. 241-246.

that $k_L \cong 0.7$. Hence, even for $E_c = 0$, $E_0' \cong -3.3$.

The government measures to hire additional workers at the prevailing market wage rate cause the market demand curve to shift to the right by an amount, say, dL_0. Thus, from $dL_D = l_D dw + dL_0$ and $dL_S = l_S dw$,

$$dw = \frac{\left(\frac{wdL_0}{L}\right)}{(E_S - E_D)} , \tag{26}$$

and

$$dL = \frac{E_S dL_0}{(E_S - E_D)} , \tag{27}$$

thus

$$dY_L = Ldw = wdL = \left(\frac{1 + E_S}{E_S - E_D}\right) wdL_0 . \tag{28}$$

Now, since $dc = wdL_0$,

$$\frac{dC}{dY_L} = \frac{E_S - E_D}{1 + E_S} .$$

Since it seems likely that E_D is large numerically, both absolutely and in relation to E_S, it would seem that the policy considered in this paragraph would be a relatively costly one. In the limit as E_D becomes infinite, $dY_L = 0$, regardless of the size of dL_0.

In the evaluations discussed in Section 3, the labor supply elasticity was taken to be the elasticity of hours worked with respect to wages plus (where the policy was presumed to apply to

families otherwise without earnings) the elasticity of labor-force participation with respect to wage rates. In the case of a compensated wage subsidy, of course, only the substitution effect of the wage change is relevant. Bounds on the cost of the program per dollar of additional earnings were determined by substituting values of the labor demand elasticity of -3.3 and $-\infty$ in turn into the appropriate equation developed above.

Appendix D

INTERSTATE REGRESSION RESULTS

Appendix D

INTERSTATE REGRESSION RESULTS

This appendix describes the interstate regression results summarized briefly in Appendix B.

Of all the variables described in Table D1, the annual earnings of male operatives, ERNOPR, had the strongest simple correlation, ≈ .9, with the median income of non-farm families, MEANNF, using census and other data for the 48 centerminous states for the period around 1960. When either property income per family, PRYINC, or the labor-force participation rates of males 14 years old or over was added to the regression equation, R^2 rose to about .89, while adding both yielded and $R^2 \approx .92$. Furthermore, adding the median annual earnings of female clerical workers (not shown in Table C1), which probably reflects both the annual earnings and the labor force participation of an important group of secondary workers, and transfer income per family, TRNIC, and $R^2 \approx .94$ was found and all variables had positive "t"-ratios of 2 or better. In particular the "t"-ratio of ERNOPR was + 7.4 and that of LBRFRC + 5.1.

I had originally thought of ERNOPR as a measure of earnings of a group of workers of similar skills, and had expected variables related to the composition of the labor force by skill also to be associated with inter-state income differences. Among the most important variables related to this latter characteristic are measures of education. I also thought that adding measures of education into the regression might reduce the importance of the earnings variables previously described. One might argue, for example, that in states where annual earnings are above-average they are so at least partly because workers are better educated and thus more skilled. The two most important variables related to education included in the study are median years of school completed, YRSCHL, and average expenditures per pupil,

Table D1

DESCRIPTION OF VARIABLES INCLUDED IN REGRESSION ANALYSES, 48 STATES, 1957 and 1960

Name	Description[a]
ERNOPR	Median earnings of male operatives, 1959
LBRFRC	Percent of male population 14 years old and over in the labor force, 1960
MEANNF	Median income of non-farm families, 1959
PDNWAG	Index of production worker wages paid divided by production worker manhours in a given state relative to the U.S. average for the same two-digit manufacturing industry, 1957
PRYINC	Property income (dividends, interest, and rental income of persons) per family, 1959[b]
TRNINC	Transfer income (both governmental and private) per family, 1959[b]
UNEMPT	Percent male population 14 years old and over who were unemployed, 1960
FARM	Percent of population farm, 1960
RURNF	Percent of population rural non-farm, 1960
NWHI	Percent of population non-white, 1960
MGRNT	Percent of population 5 years old and over in 1960 who live in different counties in 1955 and 1960
SOUTH	Dummy variable taking the value 1 for states in the South Atlantic (exclusive of Delaware and Maryland) and South Central Census regions plus New Mexico and Arizona and 0 for all other states
SFARM	SOUTH X FARM
SRVRNF	SOUTH X RURNF
SNWHI	SOUTH X NWHI
SMGRNT	SOUTH X MGRNT
MALE	Percent of population 18 years old and over who were male, 1960
YOUNG	Percent of population under 21 years old in 1960
AGED	Percent of population who were 65 years old and over, 1960
YRSCHL	Median years school completed, population 25 years old and over, 1960
EDNEXP	State and local government expenditure per pupil on education, 1962[c]
SCDYPL	Percent of elementary and secondary pupils in secondary schools, 1960
WLFEXP	State and local governmental expenditures for health and hospitals per family, 1962[d]
OTHEXP	State and local governmental expenditures for all other purposes (except highways) per family, 1962[d]

a. Except for SOUTH, natural logs of all variables were used. Data on property and transfer income are from the Office of Business Economics, those on state and local governmental expenditures from the 1962 Census of Governments, all as reported in the Statistical Abstract. The data used in constructing the variables PDNWAG are from the 1957 Census of manufacturers. All other data are from the 1960 Census of Population.

b. State total for 1959 deflated by 1960 families as of date of Census enumeration.

c. Expenditures per capita in 1962 divided by 1960 ratio of pupils to 1960 population as of date of Census enumeration.

d. Expenditures per capita in 1962 multiplied by 1960 average size of family as of date of Census enumeration.

EDNEXP, which were interpreted as being related to the quality of schooling in various places. In addition, the proportion of elementary and secondary pupils in the latter category was included as a control variable for EDNEXP, since secondary education tends to be more costly than primary. Indeed, YRSCHL and EDNEXP had simple correlation coefficients with MEANNF of about + .71 and + .81, respectively. However, when the education variables were allowed to enter the regression equation described in the paragraph above, YRSCHL and SCDYPL had the wrong signs and EDNEXP a "t"-ratio less than unity.

The other variables described in Table D1, with the exception of PDNWAG, all reflect factors which, for a variety of reasons, one might expect to be associated with inter-state income differences. It is well-known, for example, that incomes tend to be higher in the more highly urbanized states and lower in the South and in states where a high proportion of the population is nonwhite. In addition, the incomes of farmers and of nonwhites tend to be lower relative to those of the rest of the population in the south than elsewhere in the country. Also included were the state and local government expenditure variables in the list to be examined in view of the assertions regarding the importance of government services which lie behind current regional economic development programs. However, when these others and the education variables were permitted to enter the regression equation (if having a sensible sign and a "t"-ratio greater than one), the addition of variables meeting these requirements added little to the explanatory power of the regression equation and resulted in very little change in the coefficients of ERNOPR, LBRFRC and PRYINC.[1]

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1. The "t"-ratios of the female earnings variable and LBRFRC fell below unity and were deleted. They were replaced by FARM and YOUNG with negative coefficients and HLHEXP and the average size of family with positive coefficients. I would interpret the latter as reflecting more workers per family. With the exception of YOUNG, none of the latter four variables had a "t"-ratio as high as two numerically.

From the preceding results it is clear that differences in the annual earnings of employed workers and, to a lesser extent, labor-force participation are of great importance in accounting for differences in the incomes of nonfarm families among states. It was this finding which led me to think through the analysis presented in section 3.1 and in section B1 of Appendix B.

In the three regression equations presented in Table D2 the variables measuring hourly earnings opportunities (PDNWAG), other income (PRYINC and TRNINC) and unemployment (UNEMPT) were introduced first. The measure of hourly earnings used is an index of hourly wages of production workers in a state relative to average hourly wages in the same two-digit manufacturing industry, weighted by production worker manhours for the particular state and industry. To the extent that differences in the skill of workers are associated with differences in industrial composition they are eliminated from PDNWAG, but differences in the skills of workers in the same two-digit industry are reflected in it.

Also included in the list of variables for potential inclusion as explanatory variables in the three regression equations were those listed in Table D1 after the first seven. Many of these may be interpreted as taste variables. The population age variables, for example, were included because of their well-known relationship to labor-force participation rates and the strong possibility that they might show a similar association with hours worked. It might be argued that the greater the level of education of the population the stronger the preferences for work over leisure. On the other hand, a positive association between education and work may merely reflect the fact more highly educated workers work longer hours to recoup that part of the costs of their additional education which they have born themselves (cf. Finegan[2]). Finally it might be argued that certain state and local government expenditures--for health and hospitals as an example--enable workers to work longer hours than they otherwise would have.

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2. Aldrich T. Finegan, "Hours of Work in the United States: A Cross-Sectional Analysis," Journal of Political Economy, LXX (Oct. 1962) 452/70.

Table D2

REGRESSION EQUATIONS EXPLAINING ANNUAL EARNINGS, LABOR-FORCE PARTICIPATION, AND MEDIAN INCOME, NON-FARM FAMILIES, 48 STATES, 1960

Explanatory Variable	Dependent Variable		
	ENOPR	LBRFRC	MEANNF
PDNWAG	.71 (.11)	--	.46 (.11)
PRYINC	-.11 (.045)	--	.073 (.045)
TRNINC	-.20 (.10)	-.022 (.018)	--
UNEMPT	-.086 (.041)	-.062 (.0088)	-.10 (.038)
RURNF	--	--	-.031 (.027)
NWHI	.023 (.010)	--	--
MGRNT	-.16 (.036)	-.030 (.0090)	-.088 (.030)
SOUTH	-.73 (.094)	-.11 (.014)	--
SFARM	-.10 (.023)	--	--
SRURNF	--	-.051 (.010)	--
SNWHI	-.16 (.024)	--	-.065 (.022)
SMGRNT	--	--	.14 (.033)
MALE	--	.48 (.12)	--
YOUNG	-.70 (.22)	-.14 (.032)	-.60 (.22)
AGED	-.19 (.064)	-.12 (.011)	-.32 (.063)
YRSCHL	.38 (.15)	.0[illegible]4 (.027)	--
ENDEXP	.23 (.066)	--	.087 (.070)
SCHYRL	-.54 (.15)	--	--
WLFEXP	.08[illegible] (.028)	--	--
HLHEXP	--	.01[illegible] (.0059)	.049 (.003)
R^2	.97	.96	.94

All the regressions described in Table D2 were run using the double step-wise regression program described by Bailey and Davis.[3] The variables PDNWAG, PRYINC, TRNINC, and UNEMPT were entered into the regression equation first. Following this the variable which would have the highest "F"-ratio provided that it exceeded unity was added to the regression equation, and any variable whose "F"-ratio fell below .5 was dropped. Once there were no more variables to be added or deleted the "F"-ratios were changed to 2.0 and 1.0, variables being deleted if their "F"-ratios were below the latter. In addition, any variable with an implausible sign in the final regression equation was deleted from the list of variables for potential inclusion and the problem was run again.

In the equation with ERNOPR dependent in Table D2 the "t"-ratio of PDNWAG is about 6.5 while those of PRYINC and TRNINC are both about 2. In the LBRFRC equation, however, the only one of these to remain in the final equation is TRNINC, and its "t"-ratio is only slightly greater than unity in absolute value. Thus, it would appear that labor-force participation depends primarily upon factors other than earnings opportunities and income from sources other than earnings. Of the other variables, the coefficient of MGRNT is strongly negative in all three equations, and several of the variables related to the South likewise enter with strong negative coefficients. As might be anticipated, the population age variables are also strongly negative in all three equations, and YRSCHL and EDNEXP enter positively as anticipated in two of the three equations.

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3. Martin J. Bailey and Kay A. Davis, The CDC 1604 Stepwise Regression Analysis Program, Institute for Defense Analyses, Economic and Political Studies Division, N-190 (R), February 1965.